

SOME PHILOSOPHICAL THEORIES OF THE VISUAL
PERCEPTION OF SPACE AND THEIR RELATIONSHIPS
WITH EXPERIMENTAL PSYCHOLOGY

John M. Gray

A Thesis Submitted for the Degree of PhD
at the
University of St Andrews



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by

JOHN M GRAY

Being a thesis submitted for the degree of Doctor of Philosophy
at the University of St Andrews, October, 1981



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A B S T R A C T

Chapter One introduces the theory which is based on three postulates derived from pragmatism, empiricism and constructivism respectively. Veridical perception is seen not as reflecting the world as it is in some absolute sense, but as providing guidance for effective action. Its ability to do this depends on its relationship to active touch. This relies on their both being forms of action, i.e. they both consist of the operation of schemata which are at the same time guides for action and products of action.

The second chapter relates how versions of these postulates have appeared, singly or in pairs, in previous theories especially those of Berkeley, Kant and Schelling. Then MacMurray's theory, which embodies all three postulates is introduced, and this is related to Gibson's theory.

Chapter Three discusses how the key terms in the theory, image, percept and schema, relate to each other, and argues that they all reflect the same underlying psychological process.

Chapter Four is concerned with dynamic and hedonic aspects, with how perception relates to motivation and feeling. Conventional theories see any such relation as external and associative while those based on perceptual schemata allow both external and internal relationships. These different sorts of theory are compared over a wide range of phenomena. Only the schemata based theory can account for all of the effects.

Chapter Five starts with a brief discussion of the limitations of information processing type models in psychology, particularly with respect to dynamic aspects. With these in mind, it goes on to develop an outline model. Construction of the model draws attention to two important aspects of the theory; the non-existence of a pure metric representation and the lack of any strictly causal link between retinal stimulation and percept.

Chapter Six examines the literature on adaptation to optical re-arrangement, a convenient method of studying the relationship between spatial vision and touch which is a key issue for the theory. While the crucial re-arrangement is impossible to produce, the weight of evidence supports the sort of theory proposed here.

Chapter Seven compares this theory to others, particularly Neisser's, and suggests other areas of application in both visual perception and general psychology.

I declare that this thesis is my own unaided work, except where due acknowledgement is made, and has not been submitted for any degree or diploma in any other university.

John M Gray

I certify that this thesis is the unaided work of the author,
except where due acknowledgement has been made, and has not been
submitted for any degree or diploma in any other university.

F C Quinault

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CHAPTER 1: INTRODUCTION.

1.1 INTRODUCTION.

The major question in philosophy is the nature of the relationship between our cognition and the world, and the major question in psychology is just how this relationship is realised. These are, of course, highly inter-dependent questions, but the focus here is on the latter. Any attempt to answer this question must allow hope of plausible answers to other major questions in psychology - about the role of our feelings, emotions and motivations in our mental economy, and about their relationships to the world or our thoughts about the world. Not all recent attempts have allowed this.

The outline of one sort of answer is given in modern information processing type theories of cognitive psychology. These have been applied both to conceptual, verbaliseable thought and to perception. In the former, the concern is with representation; with the structures with which we represent the world to ourselves, and with the procedures with which we manipulate these structures. Much work has been devoted to the understanding of this sort of process in adult humans. Thanks to Miller (1956), Bruner et al (1956), Newell et al (1958) and many others, we know a good deal about

this aspect of cognitive psychology. However, all this knowledge turns out to be strangely disappointing. What is explicated in such theories is not mind, not any sort of human, or even animal, mind, but something like the rules for performing some rather simple symbol manipulation tasks which humans find useful to perform, or something like the rules for building or programming a computer to do them. Part of the reason for this is a lack of concern for emotional and motivational factors in cognition. If they are considered at all, they are treated as something extrinsic, something affecting the natural course of events from the outside. More recently, some progress has been made. This level of mainly symbolic operations is largely a social phenomenon, and cannot be understood apart from the social and linguistic forms which embody it. This is increasingly appreciated. Recently, interest has been directed to the influence of language on cognition (e.g. Clark, 1969; Meyer, 1970). Unfortunately, this development was vitiated by the fact that language was treated more or less as an intellectual skill, a form of cognition. This was largely due to the influence of Chomsky (1957, 1965). Nevertheless work is now being done on the social and interpersonal basis of cognitive tasks, especially in developmental psychology (Donaldson, 1978). However, the work is still largely structuralist in orientation in that it reduces those social and interpersonal factors to representations, competences, and the like. Thus, although something is

gained, in that the range of phenomena studied is widened to include essential, hitherto ignored aspects of cognitive functioning, something is also lost, in that the nature of these wider aspects is misconstrued by their being assimilated to the merely intellectual.

The situation is much the same in perception. Although it is much and well studied in psychology, it is not studied in relation to any wider theories of psychological functioning. It is often concerned with more peripheral processes, and often concerned with the analysis of very abstract functions and processes which operate in isolation in only the most artificial of laboratory situations. The inter-relationships both within visual perception, and between it and other aspects of psychological functioning are ignored. Yet these are not only interesting in their own right, but can illuminate our understanding of the processes and functions studied in laboratory experiments. Perhaps the answer is to ask, not about knowledge and representation, but about consciousness of the world. Since consciousness is the totality of our relationship with the world, this offers greater promise of the sort of integration of cognitive and orectic aspects of mental functioning which is required.

Now, what follows is a discussion of various theories of visual perception. This is a vast field, of course, including perception of space and form, of

persons and personal or emotional expression, of symbolic forms, and so on. Here, the primary focus is on those most basic aspects of form and object perception. However, since the concern is to provide the basis of a theory capable of being integrated with the whole range of human mental functions, the discussion will embrace the relationship between these aspects of perception and emotion and motivation. Since person perception is not included, the concern with emotion and its relationship to perception will lean heavily on aesthetics. However, it is hoped to show that this aspect of the study of visual perception, usually considered peripheral, is in fact basic to an understanding of the relationship between perception and the world.

To begin with, we shall be discussing the theories of philosophers like Berkeley, Hume and Kant. These are theories about how humans function, in this case about how humans function when they see this or that. They are couched in more or less ordinary language, but they are scientific theories, in the sense that experimentally testable hypotheses in operational terms are derived from them. Most science has this dual aspect where ordinary experience is described and questioned firstly in more or less ordinary language, but the search for answers requires a special, technical language, normally used to describe a special sort of restricted or artificial situation. In social science, the two halves of the enterprise have normally been conducted by

different people. The ordinary language theories have generally been intended to account for rather broad aspects of our experience, and have generally been accorded the status of philosophy. However, that should not disguise the fact that what is at issue here are questions, not of metaphysics, but of theoretical psychology.

Nevertheless, we shall have to concern ourselves with two related metaphysical assumptions which we shall call intellectualism and dualism. These are important because they have bedevilled all attempts to give a coherent account of experience. By intellectualism is meant the belief that human knowledge is originally and typically intellectual rather than practical. It thus includes all the traditional epistemologies of rationalism, empiricism, and idealism, and is opposed by pragmatism. Dualism is ^a corollary of this, and is used in a rather wider sense than usual. In this sense, it applies not only to traditional dualist philosophies, but to many forms of idealism and materialism. It refers to any theory which sees consciousness primarily as something separate from its objects. Intellectualist theories, whether empiricist or rationalist, are always dualist, and always dualist in two senses. Firstly, they separate off mind from its objects, whether these objects are seen as products of the mind, or as external objects or influences. This raises all sorts of problems in epistemology, virtually insoluble within this frame

of reference. Moreover, derived from this subject-object dualism, there is a second split between cognition and emotion, emotion becoming a sort of internal object of our cognition, rather like a sort of mental sensation. This raises parallel, equally insoluble problems in psychology. In particular, it allows for only external relations between contents of consciousness.

It has become a common theme among philosophers that traditional western attempts to understand psychology and epistemology have suffered from an overly intellectualist approach. For example, Kenny (1963) says,

"Research has been centred on the contemplative rather than the active, on the intellectual rather than the emotional and voluntary aspects of human life. Knowledge rather than action, belief rather than emotion, the intellect rather than the will have been the central topics of philosophical concern."

Accompanying this, perhaps as a cause, perhaps as a consequence, has been an overinvestment in a particular metaphor which sees vision as the prototype of all perception, indeed of all knowledge. Macmurray (1957) puts it so;

"Philosophical theories of perception . . . tend to be theories of visual perception. They assume the primacy

of vision . . . proceed as if a true theory of visual perception will apply, *mutatis mutandis*, to all other modes of sense-perception.

. . . vision has tended to be the model upon which all knowledge is construed. Thought is taken to be inner vision. Reflection is 'contemplation'. The basis of science is 'observation', and the scientist is 'the observer'. When we talk of the world which we discover in sense-perception as the world which we come to understand by reflective thought, we usually mean the world that we see when we use our eye."

Among psychologists, as among philosophers, this concern with receptivity as the basis of knowledge has led to error not only in theories of perception, but in theories of wider aspects of mental functioning. The need is for a theory using action as the primary mode of relating to the world. The focus will be on visual perception, but there will always be a concern to relate to more general issues, to provide an outline of a theory of how we know the world, and of how this knowing is a part of our total relation with the world.

Of course, action based theories of consciousness have their precursors. Berkeley, for instance, correctly intuited that the connection between our experience of space and the world depended on bodily action. Unfortunately, his dualistic assumptions led him into

ambiguity and incoherence. Kant, following Hume, challenged these assumptions. He showed that there were pre-conditions for experience, any experience, and that these took the form of an active, organising subject. However, the activity involved was purely mental, and as long as this remained the case, there was no obvious connection between perception and reality. The only way of solving this is by rejecting the dualistic assumption. This can be done either by absorbing the world into the mind, as in Fichte, or by absorbing mind into the world, as in Schelling. However, even in Schelling the connection remains somewhat tenuous, for although he relies on activity, it is of a rather refined sort, artistic creation and appreciation. Macmurray closes the circle by firmly rooting imagination in our capacity for bodily action.

The notion supported here is that consciousness is primarily consciousness of doing something rather than of something happening to us. No-one denies, of course, that we are conscious of both what we do and what is done to us, but the tendency has been to assimilate active consciousness to receptive. We do something, and we know that we do it only because of special internal senses like kinesthesia. This was Descartes' position, and also that of empiricists such as Locke, Berkeley and Hume. The notion stems from, and is given some support by, the fact that we sometimes do things without being aware of what we are doing. When we turn our attention,

or have it drawn, to our actions, we may even be surprised. The implication would seem to be that in order to know what we are about, we have to observe ourselves, direct our senses inward. Of course, this is not pure receptivity; directing the attention is a form of action. Nevertheless, here we have active consciousness reduced to a form of perceptual consciousness. There are, of course, many other states or contents or aspects of consciousness; motives, emotions, feelings, and so on. They are seen, in these terms, as objects of inward gaze.

It might be doubted, however, that we need to monitor ourselves to know what we are doing or feeling, to see if we are happy, for instance. Indeed, it might be doubted that if we are neurotically checking up on ourselves all the time, we could be happy. Another possibility is that we have several consciousnesses, sensory, motor, motive, emotional, and so on. In particular, we might be aware subjectively when we are perceiving, and aware agentively when we are acting deliberately. One difficulty is in separating out perception and action, for action requires some minimal knowledge of the world. The other possibility, the one adopted here, is to assimilate perceptual to active consciousness.

This doctrine of the primacy of action can be understood in a number of senses. Firstly it can be

taken to mean that visual perception is for action, that it is the perception of affordances for action. Secondly, it can be taken as signifying that perception is related to action in the sense that it depends on ordinary, instrumental action. That is to say that perception develops, ontogenetically, phylogenetically, or both, and that this development is guided by contingencies which, whether operating through learning by re-inforcement or natural selection, are dependent on instrumental action in the external world. Thirdly, it can be taken as signifying that perception is a sort of action, that the experience of seeing an object is the conscious correlate of a particular type of action supported by that object.

Perhaps no-one would want to deny the first proposition. After all, we are used to thinking of all our functions, mental and physical, as being for something, and ultimately for survival. It might be argued that this says nothing about the operation of perception. An automaton could be constructed with some sort of sensory system to guide its actions. Whatever the system, it might construct and use any one of a number of different sorts of representation, two-dimensional images, outline maps, symbolic descriptions. It might produce the same behaviour using any of these. Here we have something for action, but the nature of the operations it performs is not related to action. However, if we drop the notion of an image, or a

percept, or some other content, we get a totally different perspective. Of course, it still says nothing about the hardware, or the type of energy carrying the information, but it does say something about the nature of the information extracted. Specifically, it says that it is spatial, and spatial in a sense that allows for no argument as to whether space is visual, tactual, or real and independent. Spatial in this context means about the sort of space in which our bodies move and act. Of course, the system was not constructed, it developed, and it developed dependent on action. Perhaps, again this can be taken for granted. But its implications are enormous, and not fully integrated into perceptual theory. Here again, it is not the case that an abstract problem about the interpretation of light is solved. Simply, light is translated into future touch, and touch is not THOUGHT to be real or true or objective, for it is not a sensation, but the experience of resistance. Taken together, the first two propositions imply:

(1) There is no surplus, no over-refinement in perception, though there may be in any percept.

(2) There is no proximal stimulus to be processed further to give an image; the layout of space is perceived directly.

(3) Plans, layouts and objects are perceived in terms of their affordances for action. What is seen is what they

will actually afford to active touch or instrumental action.

(4) There is no problem of epistemic markers. Perception is certain, although not always correct, and the laws relating it to the world are the laws of physics and not of thought.

However, there is a gap here, as long as vision is treated as a kind of receptivity. We still have the problem of the relationship between the effects of reflected light on the mind or on the nervous system, and these representations for action. This is the same problem as Berkeley tackled, but our solution is somewhat different. The third proposition involves an active, constructive model of perception, something like Neisser's (1967) analysis by synthesis model, or his (1976) perceptual cycle model. However, that is not enough to close the gap, for Neisser's models still require a lowest level of perception or sensation whose appearance in consciousness is simply a matter of registration. It is not enough to say that perception involves action, or that the final perception is the result of actions on or transactions with the world. The process of perception is the application of perceptual schemata directly on the world. The activation of particular schemata gives rise to an image which is experienced as either a percept or a mental image, depending on circumstances. This belief that the

operations of schemata directly on the world provide the basis for all forms of consciousness of the world might be called 'radical constructivism'. The key term in the theory is 'schema'. A schema is a plan for action which is, at the same time, an intuition or presentation of something involved in the action as object, goal, ground, or instrument. Alternatively, it might be defined as an organised set of activities which presuppose a definite world and thereby bring it into being.

Imagination, and perception as a special case of imagination, are intimately related to action. The nature of this link is that imagination constructs the world in order that we may act in it. The world we see is the world we act in, not because we see it as it is and our actions must conform to it, but because we must act in certain ways, and we see a world adjusted to these ways.

CHAPTER 2: HISTORICAL.

2.1 RATIONALISM and EMPIRICISM.

Epistemology asks just what is the relationship between our perception and the world, psychology asks how this relationship, however characterised, is realised in terms of mechanism or process, and developmental psychology asks how the relationship is established in the life of the individual. Descartes tried to give an answer to all these problems, which he saw as aspects of the same problem.

Cartesian rationalist theory is, more or less, as follows. Knowledge gained by the application of reason is certain, that gained through the senses, uncertain. In order to apply our reason; however, we must have some basis, some starting point. It would be a pity if this basis were to be sensual, for then all our thinking would be contaminated with the sort of uncertainty that belongs to this sort of knowledge. So, we must look for another basis, and we find it in ideas, clear and distinct ideas. Clear and distinct ideas are formed by the free activity of the mind, and owe nothing to the world of senses. However, they may be applied to it. The idea of a substance, and its division into two modes,

mind and matter, we may know simply by taking thought; they are clear and distinct ideas. That matter has extension, location, all the primary qualities, we may also know merely by considering the idea of matter. We already know, then, the possibility of matter taking up any particular configuration; our senses simply tell us which configuration on this occasion. Their accuracy is guaranteed by God, whose benevolence, and, therefore, unwillingness to cheat us can also be known simply by taking thought. Rationalists are, then, realists with regard to the world. As regards the question of mechanism, they are not so different from empiricists like Locke and Hume who see the retinal image, or something very like it, both as a content of consciousness and an accurate projection of the world. This projection becomes a veridical percept by the application of certain rules of geometry, rules which derive their validity and certitude from geometry's status - in Descartes' eyes - as an a priori science. As regards the question of how the mechanism arises, they are nativist. So, there are two debates:

(1) Empiricism versus Realism.

and

(2) Empiricism versus Nativism.

In the history of philosophy these two questions are confused and compounded, as they necessarily would be when the only alternative to learning was special

creation. However, the advent of theories of evolution changed the situation dramatically. These theories varied as to details of the processes involved, but all had in common the notion of progressive adaptation of a species to its environment over a number of generations. Evolutionalism is functionalist; that is it allows structures and processes, physical and mental, to be seen as a response to a need, and as part of a transaction with the environment. It would be possible to have an evolutionism that was about growth towards some abstract goal like knowing the world as it really is, but this would not be biological, adaptive evolution. If evolution is accepted, in one sense, rationalism dissolves; naive realism in perception is surely out in any functionalist account. Moreover, it changes the second debate into one about where the connection is established, in the life of the individual or the life of the species. However, in another sense it is re-instated, in that action, not sensation, becomes the determining factor in securing our relationship with the external world.

Berkeley, of course, is an empiricist, and rejects the notion that activity is the basic characteristic of mind. He sees consciousness as passive, receptive. Nevertheless, he is important for he makes the connection between space and bodily action, although his empiricism makes him totally misunderstand the nature of bodily action.

Berkeley insists that the objects of vision and touch are entirely different. The primary and proper objects of vision are light and colour. Distance is not an object of vision, nor is extension, form or motion. Berkeley's position is so often represented as being that a 2-dimensional picture on the retina is somehow made 3-dimensional by association with touch that it is perhaps necessary to establish firstly that he explicitly rejected that position:

"From all which we may conclude, that planes are no more the immediate object of sight than solids. so that we see planes in the same way that we see solids; both being equally suggested by the immediate objects of sight....".

(Berkeley, 1709; CLVIII)

Certainly he starts off the book discussing first distance estimation and then size, as if the problem were to get from a two dimensional representation to a three, but this is simply his mode of proceeding; to show that first distance and size, then orientation, are not the first or proper objects of sight, and to move on at last to figure.

For Berkeley, neither touch nor vision has any special claim to absolute priority. This implies that there is no question of either or both senses providing a true picture of the world in any metaphysical sense. Indeed he is quite prepared to contemplate the existence

of an incorporeal intelligence for whom space, form, extension would all be meaningless.

"I shall nevertheless . . . consider the case of an intelligence, or unbodied spirit, which is supposed to see perfectly well, i.e. to have a clear perception of the proper and immediate objects of sight, but to have no sense of touch. . . . it is certain the aforesaid intelligence could have no idea of a solid, or quantity of three dimensions, which followeth from its not having any idea of distance."

(ibid; cLiii & cLiv)

To be consistent, of course, he should also argue that such a being could have no idea of a plane or quantity of two dimensions either. He goes on to say that the objects of geometry are objects of touch, but that they are no more real for that. The interpretation of visual sensations in terms of space and objects is not a matter of truth, then, but of adaptation.

"for this end the visive sense seems to have been bestowed upon animals, . . . that by the perception of visible ideas (which in themselves are not capable of affecting, or any wise altering the frame of their bodies) they may be able to foresee (from the experience they have had . . .) the damage or benefit like to ensue, upon the application of their own bodies to this or that body which is at a distance:"

(ibid; Lix)

Berkeley believed, then, that the connection between sight and touch is a matter of contingent, probabilistic association.

" We are not to think that brutes and children, or even grown reasonable men, whenever they perceive an object to approach, or to depart from them, do it by virtue of geometry and demonstration. . . . That one idea may suggest another to the mind, it will suffice that they have been observed to go together: without any demonstration of the necessity of their coexistence, or without so much as knowing what it is that makes them coexist. "

(ibid; xxiv)

Of course, he believed that this connection was established by experience in the life of the individual. Now, as has been said, nativism is now just an issue in developmental psychology divorced from empiricism versus rationalism, and that issue is not being argued here. However, Berkeley toys with what is a very modern idea in experimental psychology, 'readiness to learn'. This means that an organism may be pre-adapted to make certain sorts of stimulus-response or stimulus-stimulus connections rather than others (Garcia and Koelling, 1966). Berkeley seems, at one point, to reject this idea, calling it a prejudice, but what he means is that it is a prejudice to believe that there are any grounds, either logical or on the basis of similarity for making the connection. He does allow that the fact that the

associations to be learned are universal and instituted by other than man makes them especially easy to learn, and, eventually he says;

"Upon the whole, I think we may fairly conclude, that the proper objects of vision constitute a universal language of the Author of nature, whereby we are instructed how to regulate our actions, in order to attain those things that are necessary to the preservation and well-being of our bodies, as also to avoid whatever may be hurtful and destructive of them."

(ibid; cXLVII)

Given the identity of the Author, it might be assumed that it is a language especially well suited to its purpose.

There are a number of issues involved in the empiricist view of space perception. One of these might be called 'object knowledge empiricism', since it involves recognising objects and using knowledge about their size and shape to help construct the space around them. Although there are those who seem to deny such effects, Gibson (1950, 1966), it seems that such a position is simply wrong, as Ittelson (1951), among many others, has clearly demonstrated. However, this is a very weak effect, and in all but the most favourable circumstances it is swamped by 'whole field' effects (Ames, 1946; Ittelson, 1952). A variant of this which has to do with knowledge of the structure of whole

fields, however, is clearly demonstrated, in the Ames room, for instance (Ames, op cit; Ittelson, op cit; Segal et al, 1966). Another issue has to do with orientation. The basic phenomenon is that objects in peculiar orientations look peculiar. Of course, this is due to memory for previous visual experience. One issue is whether orientation is measured with respect to the body, the world, gravity or the retina. Rock (1954, 1956) has shown that there is a retinal effect independent of any others that may occur. However, this need not imply that traces of stimuli are stored. We shall see later, that this effect can be derived from the form of sensori-motor empiricism advocated here. There is, however, a third issue, which is at the heart of Berkeley's theory. This is usually referred to as 'tactual empiricism', but everything hinges on what interpretation is given to the word 'tactual'. Although Berkeley talks about touch, he really means action.

" . . . what he means by saying, he sees this or that thing at a distance . . (is) . . that what he sees only suggests to his understanding, that after having passed a certain distance, to be measured by the motion of his body, which is perceivable by touch, he shall come to perceive such and such tangible ideas which have usually been connected with such and such visible ideas."

(ibid; xlv)

He is talking not only about bodily movements, or movements of those parts of the body which were likely

to be applied to the object and to which, therefore, "damage or benefit was like to ensue", but to eye-movements. He suggests that it might be the necessity of directing the eyes upwards or downwards in order to fixate those parts of the object which are painted on the lower and upper parts of the retina respectively, that enables us to label these parts correctly.

"And it seems to me the true reason why he should think those objects uppermost that are painted on the lower part of the eye: for, by turning the eye up they shall be distinctly seen; as likewise those that are painted on the highest part of the eye shall be distinctly seen, by turning the eye down, and are for that reason esteemed lowest:"

(ibid; xcvi)

Later, it will be seen that this is correct and important, but Berkeley does not develop this. He insists on calling both walking towards an object, and moving the eyes to fixate an object, touch, and treating them as forms of passive sensibility.

Berkeley is right in almost all he says. Where he is wrong, it is because of a conviction shared by all his contemporaries and almost all his successors, that perception is primarily a matter of passive receptivity, and that this, indeed, is what guarantees its accuracy. True, he does maximise the part played by action in

providing the basis for the interpretation of the visual impression in terms of space. However, he tries to do this by reducing the actual spatial content of the visual sensations to zero. He does not maintain this consistently, and, indeed, he cannot. Colour without the basic spatial characteristics of figure and extension is unimaginable, and that means impossible, as a form of sensory consciousness. As shall be argued later, when Macmurray's theory is under discussion, a non-spatial consciousness would be merely a feeling, and could not enter into a perception in the manner of a sensation. He comes very close to denuding visual sensations of all content. What he should do, of course, is dispense with them all together, but this he cannot do. Consciousness for Berkeley, as for all empiricists, is a matter of being a subject rather than an agent; a matter of becoming aware of stimuli, whether internally generated or arising from the external world, which impinge on a passive organ of sensibility. He does not allow that we can be immediately aware of what we do; we are conscious of our actions only through the medium of the stimuli to which they give rise. What is surprising is that he goes as far as he does towards a pragmatic view of knowledge. The important thing is that the perception of space and objects is an adaptation to and contingent upon our actions. This is the heart of Berkeley's theory. The remainder of this chapter is the history of attempts to reconcile the rationalist intuition of ideas or schemata operating in perception with the empiricist insight

about the relationship between vision and active touch. They are reconciled only in a materialist, or at least monist, pragmatic evolutionary theory. An essential part of this theory will be an account of imagination as a faculty which creates and operates schemata which owe their relevance to the world to their connection with active touch and instrumental action, and which operate in perception as well as memory and pure imagination.

2.2 IMAGINATION and PERCEPTION in HUME and KANT.

Imagination is the faculty of producing presentations. It is, therefore, crucially involved in all other mental functions, cognitive and orectic. It links the physical world and the senses with the intellectual. This is Kant's theory, of course, but he got it, in outline at least, from David Hume. They both inherited the traditional and obvious division of the mind into perception and understanding. Hume developed a proto theory about the role of imagination in linking these. Kant took this theory and developed it till it was very nearly right, as psychological theory, but, missing an appreciation of the pragmatic basis of mental life, got himself into an epistemological tangle which obscured this contribution to psychology.

In Hume, there is no clear distinction between having an idea and perceiving something; no clear distinction between 'perceiving apparently in the presence of an object, and thinking about it in its absence' (Warnock, 1976). He talks about impressions and ideas as different sorts of contents of consciousness, but the difference turns out to be one of degree. If we could know immediately what we do, this would suffice, but in empirical philosophy, where we know only products or contents, this can not distinguish between them.

Insofar as we can tell whether we are perceiving or imagining, this is merely a matter of strength and vivacity.

Imagination is free to 'transpose and change its ideas' which is the basis of complex ideas, and the creation of these is its ordinary function. Imagination also allows us to think about objects in their absence. By this Hume means we can call to mind an example of a type of object, as well as remember a particular individual or incident. Indeed, he goes on to say that it is imagination that allows us to think about types of objects at all, for we do this by imagining a particular object, but take it - by the power of imagination - as an example.

" . . . the hearing of that name revives the idea of one of these objects, and makes the imagination conceive of it with all its particular circumstances and proportions the word not being able to revive the details of all these individuals revives that custom which we have acquir'd in surveying them. They are not really and in fact present to the soul, but only in power. Moreover, imagination produces or threatens to produce a string of different images of the same type."

Later, he goes on to claim that we also require imagination to hold together the complex series of impressions which are our experience of the a particular

individual object as constituting a permanent object.

In Hume a particular operation of the imagination involves something like a decision, or act of will. This is most obvious, perhaps, in the case where it attributes causal connection on the basis of constant conjunction. It goes beyond merely noting the conjunction; the attribution, the belief in causality, is something injected into the situation which binds the events together and gives to the complex a new strength and vivacity as a single, unified item of experience. Belief in Hume is a matter of active synthesis and taking up, and this involves imagination. Ordinarily, we believe our perceptions, and so why does not Hume involve imagination here? Certainly, there is no reason to believe that Hume thinks that imagination is necessary in the perception of the layout of a room, say, in terms of surfaces, corners and edges. The reason is, not so much the doctrine of impressions, as the actual word, with its connotations of something formed as a whole, mechanically. Hume sometimes allows a rather different view; he certainly allows that simple ideas can be pretty small details, something like just noticeable differences, or minimum discriminable features

"Wherever the imagination perceives a difference among ideas, it can easily produce a separation."

and while it is not quite true that for every simple idea there is a simple impression, they are nevertheless subject to the same degree of differentiation. However, Hume was not very interested in impressions from the senses, or sensations;

"The examination of our sensations belongs more to anatomists and natural philosophers than to moral; and therefore shall not at present be enter'd upon."

Had he enter'd upon and followed the bent of his thought, he would have been led to postulate the existence of something like atoms of sensation from which perceptions were built. He would have been wrong, but ironically, this would almost certainly have led him to ascribe to imagination the same role in holding together sensations to create a perception as he did in holding together momentary impressions to create an object. This would have brought him very close indeed to Kant's theory which he pre-figured in so many ways.

In Hume, as in Kant, imagination offers a sort of scaffolding to experience. It holds together a series of sense impressions to constitute a permanent object. It enables us to think in general ideas, that is it ties these objects into a system which relates them to other objects as being of the same or different types. It allows us to fill in the gaps in our experience, allows us to think about things and qualities we have not seen,

not only by combination, but by interpolation (as in the case of a colour between red and orange which we have not seen, but which we can in some way apprehend because we have seen both red and orange). The part played by imagination in Hume's theory is summed up by Raphael (1977);

" The most important function of imagination, as depicted in Hume's account, is not to form mental images (which is relatively infrequent anyway) but to provide a constructional framework so to speak into which our impressions of sense are fitted as building blocks. "

Kant takes objects to be the basic units of our experience of the world. Nevertheless, he accepts Hume's point that they are synthetic. The basic function of imagination is to produce these syntheses from the material of sensibility. In Hume, of course, imagination operates on contents of consciousness; in Kant, it operates to produce them. This is Kant's basic revolutionary insight. Sensibility, through imagination, produces perceptions of objects, while understanding manipulates concepts. Imagination, then, mediates between sensibility and understanding, and shares something of the characteristics of both, passive and active, mechanical process and intentional act.

Kant distinguished two types or functions of the imagination, empirical and transcendental. The first is

the ordinary personal imagination. This is most obvious in 'pure' imagination where each person inhabits a fantasy world created and populated entirely according to his own bent. It operates in perception to the extent that when we each look out on a common field, we see a different world, a world constructed according to our different experiences, interests, and expectations. Transcendental imagination is best seen in what we would now call form perception; where we all see more or less the same physical shapes, not, according to Kant, because these shapes exist independently of our perception, but because we all impose the same, universal, transcendental form of space upon the sensible material. Related to this, Kant recognises two levels at which imagination may operate. One is exemplified in object recognition, and is called synthesis of recognition in concepts. This has to do with having "a collection of images with the general form of objects" with which to compare. The content and structure of this collection in any individual is a matter of the empirical imagination, its existence is not. The other level has to do with imposing the general forms of space and time on sensation, and is called synthesis of apperception. Its existence is a matter of transcendental imagination, its content not so, in principle, but it is perhaps true that there is no real variation possible at this level.

For Kant, general ideas, such as object, space,

etc., are like more specific ones, at the same time both the product and material of imagination. This is very like Piaget's treatment of supposedly a priori concepts such as number, through very general theoretical concepts like mass, to very specific concepts such as dog or table as all being various levels of schemata. Whether general schemata like space or more specific ones like dog are involved, they are all forms of action. The more particular schemata sometimes sound a bit like generalised pictures, or like Rosch's (1973) prototypes. Generalised pictures have been since Locke a very embarrassing concept in psychology. It will be one of the aims of the theory developed here to explain how action schemata can have this dual nature as plans for action and images, images which can vary from incident to incident yet still preserve their identity.

So far, we have been concerned with the use of imagination, that is, with the application of schemata to the world. Now, we come to consider the formation of these schemata. An explication of this issue may help us resolve the epistemological problem of what possible relation can a perception constructed by imagination have to the world. The function of imagination in creating concepts and theories and the function in creating and appreciating beauty in art and nature, are for Kant closely related. They are discussed in the third critique, which Kant calls a 'Critique of

Judgement', but which we would say, now, was about creativity.

There are three higher faculties in Kant, understanding, judgement and reason. At one point, Kant says that each of the higher faculties treats of its own material, concepts, judgements and conclusions. Later, however, he says;

"If understanding in general be defined as the faculty of laws or rules, the faculty of judgement may be termed the faculty of subsumption under these rules; that is, of distinguishing whether this or that does or does not stand under a given rule."

The relationship between judgement and understanding can be understood if a judgement is considered as a proposition. There are two sorts of proposition which might be called deictic and descriptive. The first sort, deictic, merely directs the attention to some part of the field of vision, separates out the part as figure, and apprehends it in some particular way, i.e. synthesises it under one particular concept.

'Look! There is a hawk.'

The second, descriptive, predicates something of a thing or state of affairs which is presumed to already exist interpersonally.

'The King of France is bald.'

What Kant is saying is that there are times when our imagination synthesises objects for us which we then use in judgements, higher level syntheses, and there are times when the simple synthesis under an object is at issue. Understanding is certainly capable of combining and recombining concepts to give new concepts. However, these would be mere abstractions without possible reference. Judgement is the function by which concepts are applied to the world by forming and reforming the schemata which realise them to fit the data of experience. It is creative rather than combinatorial, and its products are genuine syntheses rather than complexes. It is in science that we can most easily see judgement in operation. Here, it operates to create rules which subsume and unify many different experiences. But judgement also operates in art, and here it functions to capture the whole of the situation and unify it under a concept specially created for just that purpose. The experience of beauty, a beautiful object, is the total harmony of form and content.

Kant's views on aesthetics are an important part of his theory. Kant is operating his own version of dualism. Like many others, he makes a distinction between the world known through the senses, and the world known through reason. The world known through reason is the real world, and includes all notions of

objective value, that is of value which can oppose itself to preference or inclination, and this includes morality, most obviously. Aesthetic experiences, he feels, partake of both worlds. They are undeniably sensual, yet, equally undeniably, they present themselves as matters of value. Later on, we shall see this view that experience of beauty offers unique access to reality developed in Schelling.

Kant's theory captures the notions that the experience of beauty is akin to the experience of discovery, and that it is a return to a newness or freshness in perception. It does this by describing the experience as occurring outside the domain of the empirical (i.e. learned) concepts of the understanding. Similarly, it captures the notions of completeness and harmony. All the parts, aspects and features of the object are synthesised under one concept, each of them is essential and nothing is lacking; this is harmony of form and content. It might also be described as a harmony of understanding and imagination. Here, the idea is that, in normal consciousness, there is some sort of friction or competition between the synthesising ability of imagination, its ability to produce schemata which exactly capture the unique nature of the object, and the demands of the understanding to subsume it under already existing concepts, even at the expense of distorting it. Also, the two parts or functions of the mind, empirical and transcendental, function in harmony, and since the

transcendental is virtually the unconscious, this means that conscious and unconscious function in harmony, although this is only implicit in Kant. The greatest difficulty with this theory, of course, is that it cannot allow any perception of meaning or significance in nature or art (except in the very special and limited case of the sublime), and that it cannot handle any form of representative art, which it must treat of as second rate and derivative. This is a consequence of the rather special sort of harmony which obtains between the empirical and transcendental minds in the perception of beauty, whereby the empirical mind must simply hold its peace.

Kant recognises one other aesthetic experience, apart from beauty, the sublime. We experience this when our judgement fails in the face of something so vast or profound that it is outwith our scope. We experience this not because it fails, but because in failing it points to something beyond itself. What it points to, what it symbolises, is an idea of reason. For Kant ideas of reason are totally distinct from the phenomenal world, and cannot possibly be realised in it. They can only be, as it were, indicated by symbols.

2.3 KANT'S SUCCESSORS and the RELATIONSHIP of IMAGINATION and the WORLD.

Kant's epistemology was a failure. It failed to offer any justification for our belief in our perceptions, any real distinction between perception and illusion, and any account of veridicality. The reason for this is that, despite Kant's deliberate minimisation of the role of psychology, the theory is basically a psychological theory, an account of processes going on inside the head. It is not surprising then that it could not distinguish perception from illusion, for that is not a distinction which can be made in process terms. Similarly, it is not possible for the account to explain the success of our perceptions, for that involves the world as well as the subject. The succeeding theories were all attempts to establish a relationship between perception and the world. Some of them were a return to dualism, in the form of psycho-physical parallelism, some were idealist, and some, like Fechner's panpsychism, were hylozoistic. The trend discussed here starts as subjective idealism, and tracks through objective idealism to something like hylozoism. All these theories failed as epistemology. As in Kant, this failure obscured their possible relevance to psychology. Although metaphysical epistemological, and psychological issues are closely intertwined in the discussion, the main purpose is to understand and evaluate what was said

about the psychology of imagination at this time when the idea of imagination was at the centre of philosophical and literary concern.

Fichte believed that any science should be a logical structure derived from one basic proposition; that is, each science had one and only one fundamental idea, and the whole of that science consisted in merely drawing out its implications. Physics would consist of drawing out all that is implied in the idea of matter, or energy, or some idea behind them both. Now, philosophy is the science of sciences, and its task is to make clear the ground of all experience, the basic prerequisites of any experience. So the first task is to establish the one fundamental proposition of philosophy. As with Descartes, Fichte started with the basic, indisputable facts of mental life, that I have experience, or presentations. Presentations are of two kinds, this much is immediately and certainly clear to reflection, and only one of these has the quality of appearing to be in any way free or voluntary. This group includes our imaginings, plans, desires, where we create a state of affairs and adopt an attitude to it of wishing, intending, hoping, which implies that it is not. Some presentations, on the other hand, confront us as real and external. Fichte has to explain how some of our products appear to us so. This is the epistemological problem in an idealist guise.

There are two ways of resolving the problem, or rather two directions in which we can look for a solution; towards idealism or towards what he calls dogmatism. That is, we can proclaim the primacy of the mental, and explain everything in terms of the operations of mind, or we can proclaim the primacy of the material, and explain everything in terms of the operations of matter. There is no way our choice can be determined, save by personal inclination, by the sort of person we are. This has to be so, for we are constructing philosophy, the science of sciences, and there is nothing beyond or behind this to which we can appeal. Nevertheless, the choice is more than a whim; on it depends the whole working out of our philosophy, and if we choose dogmatism we are bound to materialism and determinism, whereas if we choose idealism we are bound to a philosophy which allows man his dignity as a rational, ethical being. Fichte is in no doubt, that not only does idealism prove to be the better as it is worked out, but that no mature personal intellect could fail to choose to recognise their own rationality and moral freedom, and make these central to their philosophy.

The consequence of choosing idealism is that everything has to be derived from the self, the pure transcendental self which defies objectification. In a passage reminiscent of the Upanisads, Fichte asks what is it that observes, something that itself immediately

becomes the object of observation when we ask that question, and what observes then, something that always escapes us, defies objectification, defies inspection. We cannot find it, cannot inspect it, but this does not mean that it is totally beyond our experience, for we do enjoy an intellectual intuition of it. However, unlike the writers of the Upanisads, for Fichte this is not a mystical intuition of a special sort of elusive entity, it is simply a part of my self-consciousness that when I am doing something, 'I' am doing it. This intuition is then not of an entity, but of an activity. In the existence of this transcendental ego Fichte believes he has found the basis for his scientific philosophy. His first proposition is, then,

"the ego simply posits in an original way its own being."

From this is derived a second proposition,

"a non-ego is simply opposed to the ego."

It is not clear in what sense this is derived; not, certainly by formal logic, but then we are still at the foundations, before logic, perhaps. Anyway, it cannot be denied that a consciousness requires, and perhaps implies, an object. In any case, as a phenomenological reconstruction of consciousness, both propositions are secure. As regards the third proposition, Fichte has

this to say,

"I posit in the ego a divisible non-ego as opposed to a divisible ego"

Certainly, Fichte has to get from an absolute ego contemplating a perfect object into the world of diversity, but it is certainly not clear how this third step is derived, and it is no longer clear whether the statements are to be taken as phenomenology or metaphysics. Of course, he has to get from phenomenology to metaphysics, for, although his method is the theoretical reconstruction of consciousness, his goal is the theoretical reconstruction of the cosmos. Fichte wants to say that mind actually brings into being the world it inhabits. If he is talking about individual minds, apart from the dubious validity of his method, he has two problems. The first, already mentioned, is how it is that mind experiences some of its presentations as being determined by something other than mind; and the second is how it is, if each mind creates the world it inhabits, that solipsism is to be avoided. The first point is met by positing an unconscious activity of mind which creates what is experienced by the conscious mind as real and external, and the second by supposing that this unconscious power is a universal attribute of all minds. This, of course, is nothing other than the Transcendental Imagination. However, it does not quite fit the bill. A universal power of creative imagination

will guarantee us an intersubjectively veridical world in Kant's theory, because it will impose the same form of appearance every time it meets the same external (noumenal) circumstances, but in Fichte there are no circumstances at all. Either we could have no differentiated world at all, or it could differentiate on the basis of internal mental events like desires or hopes, and in this case, it would not be consensually valid. If, however, he means, not individual minds, but some sort of 'one mind' or absolute, there are problems about the relation between this mind and ordinary individual minds. If it creates individual minds, it is not clear how this differs from dualism.

Of course, Fichte certainly did not solve the problems raised by Kant. Indeed, his philosophy is always obscure and sometimes bizarre. Nevertheless, he does represent an advance in that he does preserve many of Kant's insights about the nature of our experience and the role of an active constructive faculty in shaping it, and he does try to express these within a genuinely monist framework. He chooses the wrong form of monism, true, but within the limitations imposed by this choice he works out the framework of a constructive, monist epistemology. This involves him in rather strange speculations on the nature of Absolute Mind, which are not particularly relevant to psychology. However, we can, perhaps extract from Fichte's theory what it is he is saying about the operation of individual minds. There

are, basically, four propositions:

- (1) Consciousness is an activity.
- (2) Consciousness is always consciousness of something.
- (3) Consciousness and its object are mutually determining.
- (4) The activity of consciousness is able to come to grips with its object - to know it, if we are talking about conscious consciousness, or to determine it, if we are talking about unconscious consciousness - because it is of the same stuff.

Fichte was basically a thoroughgoing subjective idealist. He talked for most of his life as if the individual mind constructed the world it inhabited, and it is all but impossible to make any sense of his theory, or, at any rate, of its deduction on any other terms. Later, however, he was to repudiate this view and claim - under threat of dismissal from his post for heresy - that he had always meant the Absolute Mind, God, but when he did this he was not believed by his theistic opponents, and he was accused of plagiarism by his one time pupil, Schelling (Coppleston, 1963).

Schelling very early on saw the incoherence of Fichte's subjective idealism, the impossibility of going from a phenomenological analysis to a theory of the world. So he started, not with the individual empirical mind, but with the Absolute. His version was that the

cosmos is one single act, or rather - since there is no agent to stand apart and perform - one single activity. Schelling's Absolute was neither agent nor act, subject nor object, mind nor material, but a movement of the whole, at first material, always final, and becoming self-conscious in its own product, mind. This self-consciousness introduces a rift into the fabric of the cosmos, whereby man confronts the world as something over and against himself, rather than participating in it. This is the source of all our angst and dissatisfaction, as well as our intellectual error and confusion. However, we cannot restore the original unity by becoming unconscious - remember Schelling follows Fichte in the distinction between dogmatism and responsible philosophy - we must restore it at a higher level. The sort of reflective action he had in mind, this higher level, was aesthetic rather than intellectual. In this theory, the link between man and the world is not the ideal, which we vaguely discern through the veil of the material, but the material itself; we are the same stuff as the world through and through. This is not to say, however, that Schelling was a materialist, in the modern sense of the word, anyway. For him, mind and body were one, and, indeed, one consequence of his philosophy was that he believed he could more or less deduce the structure of natural science, and he set out to do so. So Schelling avoided both dualism and solipsism. He also avoided arguing from a theoretical reconstruction of consciousness to a

theory of the cosmos. However, it was just the fact that it was based on our reflective knowledge of our own consciousness that gave Fichte's theory any security it had. We have to ask what it is, if anything, that makes this theory more than unsubstantiated speculation. For Schelling, the experience that guaranteed all this was the experience of beauty, of the aesthetic appreciation of an object. He believed that aesthetic appreciation consists of in some way re-doing consciously the unconscious work of the transcendental imagination, and this time freely and freshly and not as a slave of the everyday conceptualisations of the understanding.

In Schelling, what was implicit in Kant becomes explicit. Art is defined as the harmony of conscious and unconscious. However, Schelling's unconscious is much richer than Kant's; it contains not only all possible forms - this is true of Kant - but all their possible significances, their possible connections with the life of man. This implies a vast extension of the notions of idea and symbol. An idea now becomes anything that could exercise any control over human action, moral, religious, emotional, sensual, and a symbol its representation in the external world. A successful work of art is still one which exhibits form and content in perfect harmony, but the content now can be any idea. The trick of the artist is to capture completely, but completely economically, the idea he wishes to express.

Schelling was, then, a sort of evolutionist. Indeed he knew about scientific theories of evolution, and saw them as, in some sense, parallels of his system. And some evolutionists, notably the supporters of emergent evolution, saw themselves as supporting his system, or, perhaps, as translating it into scientific terms. However, Schelling was not offering a scientific hypothesis the choice between seeing life and consciousness in terms of matter and energy, or matter and energy in terms of life and consciousness, was for him completely undetermined by matters of fact, it was simply another version of the choice between dogmatic materialism and responsible philosophy. Of course, he believed that his choice would ultimately be vindicated by the obviously greater adequacy of the theory which followed from this choice. Nevertheless, the theory does rest on the claim that one of the properties of stuff is that it can become conscious, become capable of these creative imaginative acts that are the bases alike of our knowledge of the determinate world, and of the determination of that world itself. In Schelling's works this is merely asserted on the basis of how certain acts, acts of artistic creation or appreciation, appear to us. It must be admitted that these acts are of a very refined, intellectual sort. Perhaps we shall have gone some way towards reconciling them with their material base if we can relate them to human bodily action. When we do this we are changing point of view drastically. Traditionally, philosophy has always accepted the

primacy of the theoretical - what we do is to determine the world and then act upon it. But if we derive our theoretical determination from our practice, we admit the primacy of the practical. This, of course, is just what Macmurray set out to do in 'Self as Agent'.

Macmurray's basic thesis is that consciousness is consciousness in and for action. He asks what is the basic form of consciousness, the most elementary form to which we could apply the label. In order to answer this, he suggests that we should proceed "by distinguishing a hierarchy of levels within our own human consciousness, such that although each level is a conceivably viable form of consciousness by itself, every higher level is viable only if it includes the levels below it." He claims, uncontroversially perhaps, that this would reveal that the lower limit of consciousness would consist in "a bare capacity to distinguish between comfort and discomfort, which is the lowest form of pleasure pain discrimination." He argues that below this there is only an organism which reacts to stimulus, although that reaction may be adaptive and adjusted to a specific end. Indeed, the whole idea of a stimulus-reaction implies a teleological structure, implies that an adequate description includes reference to an end. Such an adaptive teleological structure is contained within the idea of cause and effect as a special, more elaborated form, differing from the others by this added element of teleology. In the same way, the

idea of a conscious reaction (we are not yet talking about actions) is contained in the idea of a reaction, discriminated from other reactions by this added aspect of consciousness. At this level consciousness is entirely motive. According to Macmurray, it is occasioned by a stimulus from the environment, and is a factor in determining a reaction which is, at least putatively, an adaptation to the environment. However, it is not an awareness of the environment.

"It is an awareness, but not an awareness of anything; not of the stimulus nor of the reaction nor of the environment."

Moreover, nothing would be lost if the requirement for an environmental stimulus were dropped. Hunger and tiredness are both feelings, both enter into the determination of certain behaviours, yet they are internally generated. Of course, whether or not such internal drives are more or less primitive, biologically, than basic irritability is a moot point. However, it need not concern us here. The existence of such feelings is the clearest case of this non-sensory, motive consciousness. Macmurray's third point about this level of consciousness is that it depends on and presupposes unconscious adaptation. That is not to say that it is epiphenomenal; far from it, it is a factor in the determination of the response. Nevertheless, it is an optional extra, as it were. The adaptation could be unconscious, and consciousness could not occur in any structure that did not have this adaptive aspect to it.

This is much the same as Polanyi's point. The last point is that this level allows for considerable elaboration, i.e. considerable discrimination among different feelings, and considerable correlated differentiation among different reactions. It might be argued that this sort of discrimination leads to a different sort of consciousness. The idea of consciousness of different bodily reactions would seem to imply consciousness of a body, and consciousness of a body might perhaps imply consciousness of a non-body, of a field or environment. However, the possibility of an intermediate state of non-sensory environmental consciousness is irrelevant. Whatever the nature of the transition, Macmurray's first level of feeling consciousness gives rise to his second level of sensory consciousness.

Sensory consciousness is essentially consciousness of something not the self. Macmurray calls this, the "other", using this as opposite and correlative of the agent, in the same way that object is the opposite and correlative of the subject. The experience of the other is primarily an experience of resistance, of something thwarting the will. This is the basic level of sensory consciousness. Adaptation to this other as it is discovered in action provides a further elaboration, as in the case when we sit in an arm chair. The fully developed form of sensory consciousness is achieved when we can discover the other independent of specific instrumental acts, that is when we can create an image

of it by specifically exploratory acts. The progression from action to contemplation is shown below. (Remember, this is a hierarchical reconstruction of consciousness such that any higher level includes all lower levels.)

LEVEL 1: MOTIVE CONSCIOUSNESS.

LEVEL 2: SENSORY CONSCIOUSNESS

2a: basic consciousness of 'other'.

2b: image in action.

2c: image for action.

2d: mediated image.

Perhaps 2a is not a real possibility, and all sensory consciousness requires an image, however simple and undifferentiated. It does not matter either way for present purposes. Nor is it strictly necessary that 2c and 2d be seen in an ascending series; perhaps they are alternatives. The important thing is that they each imply 2b. Level 2d is achieved when the image of the field or object of action is achieved through a medium other than bodily contact. It is at this level we begin to talk about sense data which have to be referred to objects which somehow give rise to them. Although this is undoubtedly, in some sense, mediated perception, there is in principle no difficulty about referring the image to the object which does not arise with the previous level. Of course, there are further, more

elaborate levels of consciousness, in humans at any rate, but these are not relevant here.

Sensory consciousness is, then, just like feeling consciousness primarily motive. Of course, in the case of vision, it does not seem so. Our visual perception seems simply to afford us images of the world, knowledge of the world, and, therefore, to be primarily cognitive. Moreover, it is simply undeniable that of all the senses, vision gives us the most elaborate experience of the other. In most cases, there is far more available to us through vision than we could possibly use. Perhaps, this is what gives us the notion that vision is primarily for knowing rather than doing. However, this is simply a function of vision presenting to us simultaneously, the affordances for all possible actions, instrumental and exploratory.

Macmurray claims that vision develops from touch, and in this, of course, he is in agreement with Berkeley. However, there are important differences. Firstly, Macmurray is able to assume that vision does in some sense develop, and, since he has several different models of development available, he is able to separate out issues of how vision and touch relate to each other and the world, from issues about the precise mechanisms involved in establishing and maintaining this relationship. Secondly, he is quite clear that touch is a form of action rather than a form of sensibility, and

this more than anything else enables him to give a coherent account as Berkeley was not. Thirdly, in the passage from instrumental action to contemplative vision, we see the progressive development of contents of consciousness, percepts, images, sensations, as elements in and programs for action.

Macmurray recognises that it is possible to imagine a person without a tactual sense, but, he wants to say, only in a rather impoverished sense of imagination. As soon as any attempt is made to fill in the details of their life, thoughts feelings, etc., it becomes obvious that such a being could never become conscious. This may be true, if complete motor paralysis and complete tactual anaesthesia is meant. However, there are certainly people with no functional active touch, who never have had any real use of active touch (people with extreme congenital cerebral palsy for instance), and they are certainly not unconscious. In any case, the question is not whether or not there could be such a person, but whether such a structure could evolve, and the answer to this is surely no.

Discussion of the evolution of consciousness raises the question of on what evidence can we attribute a specific level of consciousness to a specific organism. To get from motive to sensory consciousness necessitates experiencing the other as resisting the will, i.e. tactually. Macmurray says that the other is both

opposition to and support for action, and this is empirically true for humans, but perhaps not necessary. Free swimming creatures would not experience the other as the support of their actions, but might not on that account, be debarred from sensory consciousness, provided they had the experience of resistance. However, the existence of specific patterns of complex behaviour directed towards, and adapted to, features of the external world does not guarantee the existence of this sort of awareness. We cannot say that an organism has such a consciousness on the basis of a particular performance, of course, merely mechanical or peripheral processes could achieve the same behaviour, but we can say it has not, or at least does not show it.

Of course, we are concerned with normal human vision, level 2d. We are looking for a theory that sees vision as a form of action on the environment resulting in the formation of a perception of that environment as it affords for further action, instrumental or exploratory. The principal requirement - disqualifying most conventional theories - is that the action should be performed directly on the world, and not on some primitive level of sensation. If we allow any form of consciousness, however basic, which does not depend on action, but on mere sensitivity or ability to register, then we are back to Berkeley. Of course, Gibson (1950, 1966) is the obvious candidate for such a theory. His basic theses are as follows:

(1) Features and aspects of the percept are specified directly in the pattern of light falling at the eye; not only, or even primarily, in local or momentary events, but in gradients, flows, etc., in events integrated across the whole area of the visual field and across considerable portions of time.

(2) Since there is this rich data base, there is no need to posit a role for experience or inference to help us from an impoverished, imperfect stimulus to our perception.

(3) There are no mental events, chains of inference, and no mental contents, especially no sensations, between the light falling on the retina and the perception of the world.

(4) The pattern of light at the retina uniquely specifies a particular configuration of the world, but this is not a logical or a geometrical truth, but a biological or ecological truth. The light specifies the world through a whole host of contingent facts about patterns of light and their relations to surfaces and objects in this particular world. The ability to exploit these contingencies is part of our biological inheritance. This function of specifying the layout of surfaces is normal vision.

(5) When in normal vision we perceive the structure of the world, it is the world as it affords us possibilities for action. This level of perception is built on space perception in the sense that,

"When the constant properties of constant objects are

perceived (the shape, size, . . .), the observer can go on to detect their affordances What they afford the observer after all, depends on their properties."

At this further level, experience and learning play a part in perception.

CHAPTER 3: IMAGES and PERCEPTS.

3.1 INTRODUCTION.

The preceding chapter used the terms image and percept, terms which apparently refer to certain objects in our experience. In this chapter, an attempt is made to say something about these objects. The hope is that it is possible to say something about the 'bare experience' of perception and imagery. The contention will be that this experience turns out to be something strangely indeterminate and equivocal, and that this is not a fault of our way of speaking, but part of the nature of the experience, or perhaps of experience in general. Sartre's book on imagination (1940, trans 1972) is discussed and this is used to reveal this rather odd nature as it applies to the mental image. It has long been realised that the image is elusive, but an analysis of perception shows exactly the same to be true of the percept. After imagination and perception, Wittgenstein's (1953) work on imaginative perception is discussed, and at least part of the explanation for this indeterminacy is located in the nature of the image as a procedure for determining an object as particular sort of object, and also as the result of this procedure.

Phenomenological description involves reporting experience undistorted by prior knowledge, expectations or theories; adopting 'an attitude of disciplined naivete' (Macleod, 1954). It is supposed to be pre-conceptual, that is, unaffected by any presuppositions about the nature of our experience of the world. Since such presuppositions are built into the structure of our language, it cannot be this entirely, but at least it can be pre-theoretical, and it can be pre-ontological (in the sense of not determining before the event the inventory of primitive irreducibles that are used in our descriptions). Phenomenology as a school was founded by Franz Brentano in the latter part of the nineteenth century, and developed by his pupil Edmund Husserl. Adherents to this school claim, of course, to practise the phenomenological method. As Act Psychology it was the main contemporary opposition to Wundt's Introspectionism. Since both psychologies aimed at an accurate and unprejudiced account of human experience, and since this is what is attempted here with regard to imagination and perception, it will be worthwhile, perhaps, to look at what divided these very different schools. Wundt was trying in the first place to establish the basic constituents of consciousness, and then to discover the rules governing their aggregation into more complex mental forms. These building blocks consisted of sensations and feelings. Sensations were divided and listed by modality; for instance, within touch special senses of heat and cold, deep pressure,

pain, and touch were recognised. Feelings were categorised as pleasant, painful, or indifferent. An accurate unbiased account of experience would consist of an inventory of these basic mental contents comprising the experience, and their order of occurrence. If asked what they experienced when presented with a red book, subjects had to reply in terms of patches of red colour of such and such an extension, and so on. Any other sort of language, any mention of books, for instance, was to commit 'the stimulus error' of assigning to the perceptual experience qualities of the stimulus known from other sources. Clearly Wundt committed what might be called 'the ontological error'. In trying to escape from the unconscious presuppositions of everyday language, Wundt only succeeded in imposing his own more rigid system of categories, and in trying to found a theory by the application of too rigid methodological principles, presupposed the theory he would arrive at.

Phenomenologists succeeded much better in capturing the nature of experience. They allowed themselves the whole richness of language, and determined to capture the unique and complex qualities of each concrete experience. Moreover, they tended to concentrate on full-blown experience, rather than the rather impoverished situations of the psychological laboratory from Wundt onwards. All this gives their writings the flavour of literature rather than science, but if this is what is required to remain true to our actual

experience, then let it be. They did, moreover, succeed in establishing a number of rather general principles about the nature of mental functioning. Their main tenet is the intentionality of mental phenomena. Intentionality means that each process refers to something outside itself.

'Perceptions are perceptions of something, feelings are feelings about something.' (Warnock, 1976).

The corollary of this is the doctrine of 'the intentional inexistence of things' This means, quite simply, that we can only be conscious of things as they exist in and for our intentional acts.

3.2 The INDETERMINACY of the VISUAL IMAGE.

There are a number of theories or ways of talking about visual imagery. The most widespread is that images are a sort of mental picture which we view with our mind's eye. This view is rather obviously inadequate since it is open to the same criticism as the equivalent view of a percept that it involves an endless regress of pictures and homunculi to view them. Nevertheless any account of visual imagery ought to offer some account of its intuitive appeal. Sartre's (1940) view is that imagination is a sort of quasi-perception, knowledge masquerading as perception. However, Sartre wants to differentiate imagery too strongly from perception; not allowing, perhaps, that knowledge enters into perception. So a third view is adopted. An image is just like a percept; just like a percept, not just like a picture. To image something is to have an experience just like seeing it, except that it is not experienced as being in behavioural space. When we image something we do not believe that we can grasp it or touch it, or that we can approach it by walking or running up to it. It is just this belief, or lack of it which distinguishes our imaging from our seeing.

In the first part of 'The Psychology of Imagination' Sartre analyses the experience of mental imagery and tries to say what it is to 'have an image'.

Firstly, he wants to establish that imagery is a form and not a content of consciousness. Of course, he would say the same thing about thoughts or percepts. He is not saying that there are some kinds of conscious content, but an image is not among them, but that the idea of consciousness as a sort of repository for various contents is not very useful. Since all forms of consciousness are intentional, we have to ask to what the experience of imagery refers. Sartre's answer is that it refers directly to the thing imagined, and not to an image of it.

"The imaginative consciousness I have of Pierre is not a consciousness of the image of Pierre: Pierre is directly reached; my attention is not directed on an image, but on an object."

The notion of an image as something existing within consciousness, which relates extrinsically as a picture or a symbol - to something outside, is denied. Only when the mind turns round on itself, to grasp itself as being engaged in a particular activity, imagination, can it say "I have an image". 'For Sartre ___ the mental image is an object, not of imagination but of reflection.' (Warnock, 1976).

The second characteristic is called quasi-observation. According to Sartre, perception always contains a wealth of unrealised potentialities.

It is these unrealised potentialities that differentiate imagination from perception. If we look for them in imagery, we are disappointed. The image gives all it has to give immediately; there is nothing extra, nothing still to be revealed or discovered. The best known illustration of this is in the experiment (cited in Woodworth, 1938 .) where subjects are asked to visualise a well-known, relatively long word. When asked if they can do this, subjects almost invariably respond that they can. They are then asked to spell the word backwards, and they find this task all but impossible. This, of course, is a consequence of the image being the activity, rather than something upon which this activity is performed. These first two characteristics of the image constitute this fleeting and elusive quality.

The third characteristic is "nothingness"; that is, consciousness posits an object, whether absent or non-existent, and it posits it as NOT being in the here and now. It has been assumed, wrongly, says Sartre, that first an image is constructed, then it is treated as a perception, and finally some sort of qualification is added, reducing it to the status of an image. But what really happens is that in positing the object, it is posited as non-being. The fourth characteristic is spontaneity. This is Sartre's word for freedom or lack of causal determination. If we do something spontaneously, we do it simply because we choose to. Of

course, this implies that we do it intentionally, and that we do it knowingly. Now, although these characteristics are given here in the same order as they are given by Sartre, in fact, they all derive from the fourth, spontaneity, or the free nature of consciousness. Sartre's great concern is with human freedom, and for him it is an all or nothing matter. This is his version of dualism. Therefore, since perception is, of necessity, not entirely undetermined by the environment, it must be separated off rigidly from those aspects of mental life which embody our human freedom, prototypically imagination.

One of the implications of this view would seem to be that we cannot be surprised by our images, and, indeed, Sartre makes just this implication. However, as Warnock points out, it is just not the case that we never feel surprise at an image. In fact, Sartre recognises that this is the case, at least in special circumstances like hypnagogic imagery. The fact of the matter is, that consciousness is not an all-or -nothing condition. Of course, being surprised at the occurrence of an image is not the same as deliberately creating or re-calling an image, and then being surprised at what it contains. However, Warnock insists that in certain instances we can discover something in an image. Her example is the case when we are asked if Pierre has a moustache. One way of answering this is to image Pierre, and to answer from this image. This seems to break the

principle of merely quasi-observation. But the image is surely not formed and then inspected to find a moustache. One act is performed, the act of recall; we remember Pierre moustache and all, and we remember him visually.

3.3 The INDETERMINACY of the VISUAL PERCEPT.

The first characteristic clearly applies to perception as to imagination. At first sight, the second seems more doubtful. Surely, our perception does, as Sartre puts it, "overflow" with possibilities. However, if we look closely, it is the world that overflows; our (momentary) percepts are as impoverished as our images, and in precisely the same way. When we glance at a scene, at a portion of the visual world, we are not conscious of any sharp division between what is in our field of view and what is not; we do not perceive our field of view as a sort of horizontal oval section of the world. (See Gibson, 1966 p255 for illustration.) Nor are we conscious of any discontinuity between our fovea and our periphery. We do not, for instance, have a clear foveal region and a blurred periphery. There is no sensation of blurredness at all; we are simply more conscious of what is in the fovea. Subjectively, what we have is a sort of gradient of consciousness from the centre, out to the periphery, and round behind our heads. Where our visual field ends, consciousness is already so limited that we do not notice any discontinuity. Objectively, we have a sort of gradient of effort. At the centre, everything is already there, present to consciousness, at the periphery, it would require eye movements to bring the object into focus, further out head movements, and immediately behind us,

whole body movements. When we imagine something, we have the same sort of experience, a central area where we are fully conscious of what it is we are imagining, and a feeling of something there available if we should need it. When we go for this something it is not there, not surprisingly, because there is no scene, no picture we can read off. The image is the experience, simply.

We have another sort of visual experience, a more common sort, the perception we have of a scene, a room, say, which is got not from a single glance, but made up from a whole series of glances over a period of time. Made up 'from' not 'of': this is a single perception, a single visual experience, not a series, although it can, of course, be broken down in reflection. But we can integrate information gathered over time as well as over space. When we remember, we re-experience the scene. If we freeze this experience, we find part of the scene in consciousness, and part of it available. This time, however, it really is available, and when we go for it, we get it.

Not only are particular parts, particular spatial areas, of the visual world more or less conscious, so too are particular aspects. It is a common objection to visual imagery that, while people will often report that memory for episodes often takes the form of visual imagery, when they are asked about what one of the participants was wearing, or about some other aspect of

the situation that would be available if the situation were being viewed, they can not respond. This is, perhaps, an objection to a pictorial theory of imagery, but not to a theory which says that an image is simply the experience. The participants in the episode were taken just as people; what was attended to at the time, and what is recalled as an image are the situationally relevant aspects of their presence, like their facial expressions. The colour and cut of their dress is not forgotten or left out, it simply was not seen in the first place. It was not part of the initial visual experience, and so is not part of the visual image.

It might be objected that it must be the case that our visual percepts contain colour and form, because when asked about them, we are always able to report colour and form. This is because of the sort of indeterminacy of meaning mentioned. Is the percept the percept of the room built up over time, the percept of that corner of it in the visual field, or is it the percept now, this twenty milliseconds? Perhaps, it is not just an indeterminacy of meaning, but a more radical indeterminacy in that our visual system is always extracting information over different time scales, always integrating over different time scales to yield percepts of space, objects, colours, contours, movements, events. The number of integrations, the information used, the time scale: all are indeterminate for any one of these percepts. Anyway, our percept of

the room will certainly include colour and form, but our
percept now - especially if we mean a very short now -
may not.

3.4 WITTGENSTEIN and IMAGINATIVE PERCEPTION.

Wittgenstein discusses the role of imagination in perception. Unfortunately, he concentrates mainly on pictures rather than real objects, although he does want to apply what he says to real objects. He talks about 'seeing as' or 'seeing an aspect', by which he means seeing according to a particular interpretation. He does not want to apply seeing an aspect in all situations, but only where there is some sort of ambiguity. Where there is ambiguity in a picture, it is generally created deliberately, as in the duck-rabbit. If I see it only as a rabbit, I would not say that I see it as a picture-rabbit, but simply that I see a picture-rabbit. Nevertheless, I am not doing anything different from someone who does know the ambiguity, but is presently seeing it as a picture rabbit. Someone else might say of me that I was seeing as; he is not disagreeing with me, he just knows about the other possibility. If there were no ambiguity at all, no one would say that I was seeing as, but it would still be the same thing I was doing. Wittgenstein is not here making a distinction between two processes, seeing and seeing as, but between two contexts of justification. He is, nevertheless, revealing something about processes that go on in perception whether or not there is ambiguity. The situation is rather similar to using optical illusions to reveal processes that go on in ordinary veridical

perception.

When you look at the picture object which is the duck-rabbit, you see one of two possibilities which are mutually exclusive. Yet, at the same time you see the same thing whichever possibility you choose. This is what leads Wittgenstein to say,

" 'Seeing as ...' is not part of perception. And for that reason it is like seeing, and again not like."

(Wittgenstein, 1953, p197e)

The aspect may change before your eyes. It is no good saying that what changes is the organisation, and then trying to pretend that organisation means shape; in this case, anyway, the shape remains the same whether a duck or a rabbit.

"If you put organisation of an object on a level with colour and shape you are proceeding....(wrongly)."

(ibid; p196e)

Although in the case of the duck-rabbit we have to 'know' both duck and rabbit prior to seeing the picture, this is not true in the case of the double-cross. This is partly because,

"Those two aspects(...aspects A) might be reported simply by pointing alternately to an isolated white and an isolated black cross."

(ibid; p207e)

In the case of the picture object, then, we relate to the stimulus as two things; there is, on the one hand, the actual perception, that is, the actual shape and colour of the figure, and on the other, a concurrent, also visual experience of that shape as a picture of something specific, but not necessarily recognised or familiar. Here there is the suggestion of two levels, one of which is completely determined, and hence completely secure in its relationship to the world.

Now, Wittgenstein goes on to talk about the situation where there is ambiguity in viewing an object, a real object rather than a picture-object, and the example he takes is 'a familiar object, but in an unusual position or lighting'. He has this to say,

"....the lack of recognition lasts only a few seconds. Is it correct to say he has a different visual experience...?"

Different, that is, from the person who sees and recognises the object. There are, of course, objections to this view. For might someone be able to describe an unfamiliar shape just as accuratelyOf course it will not generally be so. And his description will run quite differently. (I say, for example, the animal had long ears - he: There were two long appendages...."

(ibid, p197e)

So, it seems there are two levels even with real objects. Wittgenstein goes on to talk about the case of

seeing an old friend, not recognising him at first, and then coming to recognise him. Something changes in the visual experience; so much so that he says,

"I believe that I should do a different portrait of him now if I could paint."

(ibid; p197e)

The same applies here; a form, a body, is already constituted, and on top of this comes an interpretation as a particular person. However, seeing as is more than just recognition, but is, perhaps, a tendency to represent things in a particular way.

How do we resolve this, then? It is clearly the case that the shape of what is seen is in most circumstances fixed, yet the description of it - including its reproduction as a portrait - varies. Wittgenstein discusses this with reference to 'the representation of what is seen', which, he says, is the criterion of a particular visual experience. This concept, 'the representation of what is seen' is very elastic, 'and so TOGETHER WITH IT is the concept of what is seen' (Wittgenstein's emphasis). Speaking about viewing a landscape, Wittgenstein says we represent what we see three-dimensionally. It might be that by 'what is seen' is meant,

(1) The world, what is there for us to see.

(2) The perception, the subjective 'what we see' that

corresponds, hopefully, to what is there.

(3) Something which is neither of those, perhaps something in between.

Wittgenstein means the third, but this can be interpreted in two ways,

(1) As something in the eye or brain, or in the mind, like an impression or sensation. Something in the head, but on the periphery towards the object.

(2) As something in the world, but somehow at the boundary; proximal stimulus, or information sample, perhaps.

Wittgenstein dismisses the idea of a copy in the head, and goes straight on to talk about how our glance moves when we are looking, and about the tangled impression this makes. Here Wittgenstein is talking about constructing a single perception of a scene from a number of glances, just as was discussed with respect to perception of a room earlier in this chapter. What is meant by 'what is seen' is the fragmented, jumbled sample of the world. The 'representation of what is seen' is one of a large number of possible descriptions, any one of which would be a unique visual experience. Referring to the visual experience, he says that there is

"not (only) one genuine proper case of such

description".

(ibid; p200e)

The earlier cases, including the picture objects, turn out to be those special cases where the 'representation of what is seen' and 'what is seen' relate to each other in the very simplest of ways, simply because 'what is seen' involves only one glance. What Wittgenstein does not say, at this point, is that the description usually comes first, and is filled out by what we see. He talks as if the description were post hoc, the 'dawning of an aspect', for instance.

In the next section, Wittgenstein is talking about the aspects of a plane figure of a triangle.

"This triangle can be seen as a triangular hole, as a solid, as a geometrical drawing; as standing on its base, hanging from its apex; as a mountain, as a wedge, as an arrow or pointer, as an overturned object which is meant to stand on the shorter side of the right angle, as a half parallelogram, and as various other things."

(ibid; p200e)

The list is deliberately heterogeneous. He tries to explain these different aspects by the notion that,

"What I see something as, is what it can be a picture of."

(ibid; p201e)

This might be plausible for figures, but not for

objects. However, perhaps it can be extended to the situation where someone sees a block of wood in two contexts; in one they take it as a stool, and in the other as a chopping block. This is just the notion that what we see something as is how we represent it, but now how we represent it has something to do with context, and something to do with its role in life.

3.5 IMAGES and PICTURES.

There are, as Warnock (op cit) points out, two different types of imaginative act; imagining an absent or non-existent object, and, given some sort of perceptual experience, a painting or a photograph, for instance imagining it as something else. With regard to the second, Sartre claims that there is no difference between using "a physical analogue (e.g. a photograph) or whether we use an analogue whose material derives from the mental world." Warnock replies, "either it is simply false to say it makes no difference ___ or ___ we simply have to concede that images are things of some sort which exist in the mind as photographs exist in the world."

We do not use an image to remember a friend, we remember him imaginatively, or some other way; an image is a mode not a tool of remembering. But a picture is a tool, or at least partly, and so there is a difference. When we imagine something, simply, with no support, there is nothing there in consciousness. It is part of the definition of a thing that it is independent, offers some resistance. In pure imagination there is no resistance, no constraint; we imagine what we please. A picture, however, is a thing, it offers some resistance. There is a restricted set of solutions, a restricted set of activities which it will support; and these

activities must each bear some relation to the activities which would be supported by the presence of the thing which the picture represents, or the picture would have a merely conventional relation to its object, like a word. Wittgenstein has an example of a picture of a sphere which we may see as either floating in the air or lying down. When we change from seeing one aspect to the other what changes is clearly not 'what is seen', the visual impression, but some sort of representation. We do not see the sphere float, really;

"(And yet my impression is not that of a real floating sphere either. There are various forms of 'three-dimensional seeing'. The three-dimensional character of a photograph and the three-dimensional character of what we see through a stereoscope.)"

This is because the representation is not of what is seen - the picture-object - but of a state of affairs not immediately present. When we have a percept, there are two things, what is seen and the representation of what is seen. When we have an image, we start with the representation, and the equivalent of what is seen is generated out of it. That is why it can never contain anything fresh. The case of a picture is like that of an image in that there is a representation, but the thing represented is not available to support it. Instead of generating this support, however, we have a substitute. This will support our representation of x insofar as it

can be given the same organisation as x. Of course, one of the functions of a painting is to persuade us to represent something in a particular way. This seems to be Wittgenstein's view, at any rate, for, speaking of the aspects of the triangle, he says,

"It was as if an image had come into contact, and for a time remained in contact, with the visual impression."

It is, of course, possible to bring the image "into contact with the visual impression" voluntarily.

Wittgenstein goes on to discuss the active aspect of imagination; its relation to will and action. He talks about children playing with a chest, and pretending it is a house. For them, he claims, it actually is a house. Nevertheless, it is in some sense voluntary; they choose to play this game rather than that. Also, it involves a kind of knowledge or skill; one can know how to play a game. Later on, talking about 'aspects of organisation', he says seeing something as having one aspect and then another could only be posited of 'someone capable of making certain applications of the figure'. And then,

"The substratum of experience is the mastery of a technique."

What sort of activity is at issue? Certainly more is involved than a skill or competence, like being able to do arithmetic. For a skill may lie fallow, or may be brought into operation at will. Certainly, will is involved here, in some circumstances, but in others, it is not. Whatever is operating here is immanent in every visual experience, and will is involved not in having an experience, but, and only sometimes, in switching from one experience to another. Yet it includes a skill. What we are talking about is a habit, a tendency to produce a certain pattern of behaviour in a particular situation, and a tendency that is more than just a probability, so that it is there as a dynamic force even when it does not operate. To call it a habit, of course, is to take one side of the nature\ nurture controversy, so a tendency is better.

Until now, the representation and the visual impression have been spoken of as if they are two different things which come together somehow to make a percept. Really, these are just convenient abstractions to handle the fact that the difference between visual experiences may be one of representation (i.e. organisation) or visual impression, or both. The organisation is always an organisation of something, and the visual impression is always organised in some way. They are not different things any more than the words of an utterance are different from the phones which comprise them. This means that they are of the same

stuff, and so, since the representation is a set of affordances for action, the visual impression must be also. In general, the higher levels are affordances for instrumental action, and the lower for exploratory. Of course, they can be the same stuff only because the world affords in much the same way for both types of action. Berkeley is wrong when he says that depth, solidity, etc. are associated with particular patterns of light and shade in the same way that shame or anger is associated with blushing. However, the relationship between instrumental and exploratory action is best examined in touch.

3.6 IMAGES and SCHEMATA in ACTIVE TOUCH.

What we are doing when we explore something tactually is to create a schema of it. The function of this is two-fold, to guide further exploration, and to aid action on or with the object. The question is, how far this schema resembles a visual image, how far it is a genuine spatial representation. If the theory argued for here is to have any validity, it must be a genuine spatial representation. It might be thought that this would be relatively easy to test, by experiments on tactual learning and visual recognition of forms, for instance. Unfortunately, the issue is complicated by the fact that the tactual exploratory process, in sighted and in late blinded persons, is often helped, or at least accompanied by, 'optification', that is, by the construction of a visual image (Revesz, 1950). Hence the importance of evidence from the very early or congenitally blind. One view is that such people have no genuine spatial sense at all. This is the position of von Senden (1960), although it is contradicted both by the evidence he himself cites, and by evidence from other sources (Gregory and Wallace, 1963).

We have to ask what is specifically visual about the experience of space. Obviously, colour is one thing, but a non-visual representation of space would be more, or rather less, than a visual scene drained of colour.

It would lack, for instance, the idea of a perspective transformation. The simplest case of this is a simple scale transformation; we know that a square sheep-fold on the other side of the glen has something in common, visually, with the surface of a matchbox held in the hand, because the proximal stimuli are similar. But what is the similarity for a blind man? In one case, the stimuli consist of a series of hand grasps, and in the other a series of walks and turns. In fact, it is known that on recovery of sight, early blinded persons find difficulty with scale transformations, as in the famous Chiselden case quoted by both von Senden and Gregory and Wallace. Indeed, it would seem that this is what leads von Senden to his conclusion. Another source of evidence on this point is work which has been done on the development of tactual maps as an aid to blind mobility. A tactual map is more or less a scale model of an area, or a plan view with raised features. The subject familiarises himself with the map, and is then tested in finding his way about the area. If scale transformations are purely visual, then the congenitally blind should be terribly disadvantaged at this, as indeed they are. However, this cannot be used as evidence that they are unable to construct spatial representations, since if they are given experience in walking round the area, they are much less disadvantaged compared to late blinded and sighted given similar experience. They are, of course, tested on routes they have not walked before. (Dodds, 1980).

There is a distinction between near and far space, and this corresponds approximately to the difference between an image and a plan. If I want to present myself with the possibilities for action of a small object in near space, I conjure up a visual image of it. If, on the other hand, I want to present the possibilities of large objects in far space, I most naturally operate with a plan or map. This is a highly schematised outline image. A plan view, a real concrete image from a particular point of view, would do as well, and indeed our ability to make and use maps is parasitic on our ability to make ordinary images. However, the relationship between a map or a plan view and my action is totally different from that between an ordinary image and my action. There is no reason at all to expect that blind people should be able to transfer from one to the other, because this ability is parasitic on the ability to handle perspective. That is, what is lacking is not spatial awareness, but merely one aspect of visual awareness.

In vision, perspective transformations are involved in, and to some extent counteracted by, size and distance constancy. The perception is some sort of compromise between the proximal stimulus and the distal. This is presumably necessary in vision as a sort of play-off between the functions of guiding exploratory and instrumental action, but, of course, this is not necessary in touch. So, we would expect perfect constancy. The same would apply to orientation

constancy, Indeed, there is reason to believe that for the congenitally blind - those incapable of 'optification' - there is no decrement in a recognition task with change of orientation of target (Dodds, 1980).

There is an aspect of our visual experience which is very difficult to express in words, and it has to do with the fact that we are in some sense aware of the backs of objects, of occluded parts of objects, and of objects and space continuing out of our visual field and round behind our heads. This awareness is perfectly integrated with our awareness of what is actually given to us in the light, yet it cannot be the same; it seems foolish to say that we can see the backs of objects. Partly, this has to do with the indeterminacy of the 'what is seen', and partly with what was said earlier about visual perception being imposed on the sensible material. To the extent that it is the latter, no such problem need exist in tactual perception, since the image does not bear the same relationship to the sensible material. It would be inaccurate, but perhaps permissible as a metaphor, to say that in pure tactual perception all things are transparent.

The proximal stimulus and the representation of the object are not related in touch as they are in vision, where the representation is, in some way, on the visual impression. In active touch, the representation and the stimuli are different things, simply because the stimuli

are not there simultaneously in quantity to support the representation. On the one hand, imagination refers to objects in the here and now - perception, and on the other to objects in some other time and space than the here and now - memory and fantasy. Tactile images hover on the borderline between those two classes.

CHAPTER 4: PERCEPTION and EMOTION.

4.1 THE RELATIONSHIP between PERCEPTION and EMOTION and FEELING.

In this chapter, an attempt is made to say something about the relationship between perception and orectic or 'warm-blooded' aspects of human functioning like feeling, emotion and motivation, and to aspects which seem to lie between the merely cognitive and the orectic, aspects like judgement and value. Of course, this is an area of crucial importance for the theory discussed here, based as it is on Macmurray. If sensory consciousness is a development of feeling or motive consciousness, then the relationship between the structural features of the perception and the feelings that surround it is more than simple, external association. This is not to say that association does not occur, but simply that there are other sorts of relationship, and that these are the more primitive and essential features of our visual experience. One sort of relation obtains when structural features of the perception, its shape, size, colour, are determined, not by objective features of the environment, but by emotionally toned processes inside the perceiver's head. Something will be said about this later, but for now our

concern is with those cases where we can take individual structural features of the perception for granted. Another sort of relation obtains when we see an object and recognise it, and this triggers off a whole set of thoughts and memories and emotional reactions. These do not always feed back on the perception and affect our description of the object. In this case, we might say that the emotional complex was simply associated with the perception of the object. Of course, this particular phenomenon is not relevant to a theory of visual perception. So, we are primarily concerned with those cases where emotion and perception are so closely linked that if the emotional state were different, one would insist that the perception, or at least the visual experience, was different (cf Wittgenstein on organisation). The problems involved here are no different from those involved in the idea of organisation. What is different is the greater precision of our vocabulary for structural features as against emotional features, which allows psychologists to come to grips with one more easily than the other. Two sorts of theory are available to explicate this relationship; the traditional empiricist theory, relying on the notion of association, in this case a particularly close form of association, and the theory based on action schemata. A theory based on action schemata sees cognition and feeling as two aspects of action. Cognition, knowledge of the world, whether as a simple visual image or an elaborate symbolically encoded theory, is the structure

of an action schema. Feeling, motivation, emotion are aspects of the functioning of action schemata. Of course, in order that this can be so, action schemata must not be seen as consisting of sets of procedures, but as real physical actions, describable only in terms of energy, effort, resistance, and so on. Feelings and emotions arise from the operation, either on the world or in the imagination, of instrumental and exploratory schemata.

Consider the following situations.

- (1) Looking at very rich food when either very hungry or very full, and seeing it as either very attractive or nauseating.
- (2) Looking at coins and seeing them as more or less attractive according to their value.
- (3) Looking at a savage animal and experiencing this as threatening.
- (4) Looking at an armoured tank or a warplane and seeing it as threatening.
- (5) Looking at an icon, and feeling some sort of religious feeling.
- (6) Looking at a surface and seeing it as slimy and unpleasant. Looking at the pattern of twigs on the branch of a birch tree and seeing it as delicate. Looking at a boulder tottering precipitously on the edge of a cliff, and seeing it as unstable, shaky. Looking at a lion or a tiger, and seeing it as powerful, strong.

(7) Looking at a landscape, and seeing it as beautiful or harmonious.

(8) Looking at a bush in the dark, and seeing it as a footpad or a savage beast. Looking at a blank field when hungry, and seeing food (Sanford, 1936; Levine et al, 1942).

These, of course, are all different circumstances, but in each case we may perceive these different feelings or whatever as being in some sense in the object. However, there are differences among the examples in the type or degree of involvement of prior knowledge of the object as a member of a particular category of objects with this or that quality or attribute. In cases (1) to (5), recognition is clearly necessary, and the relation between the structural description of the perception and the emotion is purely external. It could be argued that these cases involve only simple association of thoughts and emotional reactions with the object. There is, however, some evidence that these thoughts and emotions do feedback and affect perception, even to the extent of determining structural features. In cases (6) and (7) we do not need to know anything or remember anything about the object or type of object; we do not even need to recognise it, or see it as similar to something else; the reaction is to the specific concrete nature of the object, and here perhaps some other sort of relation obtains. We shall refer to these two sorts of perception as categorial and concrete respectively.

Case (6) refers to the sort of experience we have when we feel that we have somehow gauged the quality of an object through vision. It includes things, like seeing a surface as rough or slimy, for which an explanation in terms of cross-modal learning would seem both obvious and adequate, although it is not the explanation we shall prefer. It also includes the sort of experience described by von Horstobel (Ellis, 1938) as supersensuous perception. These are similar to the amodal perceptions of Michotte (Michotte, Thines and Crabbe, 1964), but, whereas amodal perceptions are primarily objective and intellectual, dealing with such things as causality and energy transfer, supersensuous perceptions, as the name implies, are primarily subjective. They deal with something like the mood or connotations of the situation or object. They are often expressed in terms like 'dull', 'sharp', 'bright', or 'heavy', terms which clearly refer to sense experience, but it is not quite clear to which sense modality. According to von Horstobel, we can match tones of grey to tones of music and even 'find on the piano a tone which sounds as bright as lilac smells.' (op cit). The idea is familiar in a different context from the work of Osgood, Succi and Tannenbaum (1957). They asked subjects to rate a large number of words for similarity, and analysed the results to reveal the dimensions which subjects used when making such judgements. A rather limited number of dimensions were found to account for most of the results, and these included factors like

good/bad, strong/weak and bright or sharp versus dull. Osgood claimed that this procedure exposed the connotative or emotional meaning of the words. Whatever they represent these three dimensions keep on coming up in psychology, e.g. in tri-dimensional theories of emotion (e.g. Schlosberg, 1954). Case (8), of course, represents a different sort of perception or misperception, where structural features of the perception are determined by the internal state of the perceiver, rather than by the world.

4.2 EMPIRICIST ACCOUNTS of the RELATIONSHIP.

Traditional empiricist theories of perception are based on the belief that the perceptual process consists of taking perceptual primitives, atomic sensations, and putting them together to form a unified percept. This putting together involves the application of rules which are learned. It also involves the use of information from other sources, other senses, memory, etc., but it makes no difference whether the added information is a procedure or simply data upon which these procedures operate. Thus it breaks down into two propositions; atomism or the existence of quantum events localised in time and space which exist as part of our conscious experience recoverable simply by introspection or reflection rather than inference; and enrichment, which sees the final visual experience as a result of processes which add to the information in the sensations. True, processing is not necessarily a one way flow from sensation to perception; products at higher and intermediate levels can be seen as affecting the interpretation of items at a lower level, but it is only their interpretation or organisation which is at issue. Whatever the subtleties there are basic building blocks, these are part of the final experience, and they correspond to local, momentary events at the retina. Empiricist theories of emotion are similar. Among the

elementary contents of consciousness are the basic feelings. Feelings can join with other feelings or with memories or sensations to form more complex constituents of mental life like emotions.

Traditional empiricists will call upon learning or stimulus enrichment to explain the phenomena in question. This account has a good deal of plausibility in cases (1) to (5), or in any case where the identity of a particular object or type of object is involved. In example (1), for instance, the argument would be that feelings of desire or nausea become associated with the stimulus object via classical conditioning. The fact that either response is possible in the same organism would be an example of state-dependent learning. The feeling becomes so closely associated with the stimulus that it is invested in it, rather like spatial properties in Berkeley. It could be that the case of seeing coins and seeing them as attractive, as in example (2) is rather different from seeing the food and seeing it as either desirable or nauseating, and that while the former is an entirely arbitrary and contingent relation, the latter involves a certain 'readiness to learn'. A similar difference might exist between cases (3) and (4). However, these are the situations where the relationship between perception and feeling is external, and so it is only to be expected that some such mechanism as association would fit the bill.

In cases like (6), it is still possible to defend an empiricist account for some of the examples. Clearly seeing a particular pattern of stimulation associated in fact with a slimy surface, and responding to the sight by in some way feeling the sliminess is perfectly well accommodated in an associationist learning framework. The next example is slightly more complicated. A particular pattern of proximal stimulation gives rise through inference and enrichment to the perception of a particular spatial configuration. On the basis of this spatial configuration plus some empirical generalisations, like the law of gravity or the knowledge that strength is often inversely related to thickness, some further inferences are made, e.g. 'the rock might fall' or 'those twigs would snap if handled roughly'. These inferred possible situations are associated with particular emotional states presumably through classical conditioning and stimulus generalisation, and these emotional tones are then invested in the object. The third and fourth examples are impossible. Take the fourth, the example with the tiger. Clearly, if we ever encountered a tiger, the emotion we would be most likely to feel and to learn to associate with tigers would be terror. If the situation were somewhat different, we might learn to associate aesthetic pleasure. However, we could never learn by association to feel the tiger's power. Yet, that's what a tiger means to us. Oil companies do not spend a fortune on advertising to frighten us away from their products.

Case (8) provides grave difficulties for an empiricist account. There are clear cases where the effects of internal states, whether cognitive or motivational, result in non-veridical perception. As regards motivational effects, there is the effect of hunger on the perception of food where none is present (Sanford, 1936; Levine et al, 1942), and as regards expectancy or set, there is Bruner's demonstration that a red two of spades can be seen as black (Bruner and Postman, 1949). Any empiricist theory must handle these effects by ad hoc explanations which run quite counter to the spirit of the general theory.

Within the category of emotionally toned veridical perception there are two possibilities: projective, where the emotion or feeling is projected onto the object because of the perceiver's prior state, and reactive, where the emotion or feeling is in some sense more obviously a consequence of the perception, although it feeds back into it to give it a particular quality. This corresponds to the distinction between categorial and concrete. Both these possibilities are realised. Cases (1) to (5) would be examples of projective or categorial, as would case (6) in this account, while case (7) would be reactive or concrete. Aesthetic appreciation would simply be the natural response to some perhaps rather complex stimulus properties such as harmony and proportion. Notice that these are properties of the bare stimulus, or of the sensations, and have

nothing to do with anything added by memory or inference. Because of its relationship with the notion of sensation this sort of perception is of strategic importance. However, before going on to discuss it, we shall look at the alternative account.

4.3 ACTION BASED ACCOUNT of EMOTION.

Association is an external relationship in the sense that the individual nature of the object is not conditioned by the other objects in the relationship or the relationship itself. The claim here is that emotions and percepts are not different types of conscious content, but different aspects of a unified agentive consciousness. To establish this, we have to show that feeling and sensation are both related to action, and show that they are internally related as aspects of action. In this section, then, we are concerned with theories of feeling and emotion. There are two theories of emotion which dwarf all others both in terms of the range of phenomena they handle, and the richness of the descriptive schemata they employ. These are the theories of St. Thomas Aquinas and Sigmund Freud. Of course, it is not possible to describe, discuss and defend these theories here. We shall content ourselves with showing that they are both compatible with the views being expressed here.

The phenomena exemplified in cases (1) to (7) seem to lend themselves to description in terms of concepts which fall naturally into two categories; the first has to do with such constructs as desire, motivation, and appetite, and the second with value and reason. In the

examples above, (1) and (2) would be described in terms of appetite and (5) and (7) in terms of value. This distinction cuts across that between categorial and concrete, then. It applies to dynamic aspects of the perception and it presupposes two different sets or sources of emotions in humans. Of course, in the version of dualism current at this time appetite is seen as pertaining to the body, or the animal nature of man, and value to the soul, or divine nature. Traditionally, the two are set against each other. A common theme in mediæval literature, for instance, is the need to discipline the imagination and so ensure that it, and hence the senses, are the servants of reason or value and not of appetite or passion (e.g. Richard of St. Victor, c1180). The same division appears in Aquinas, but we shall see that it is not consistently maintained for one sort of value, aesthetic value. This is the sort of value most relevant to theories of visual perception.

Aquinas characterised impulse as consisting of two parts, intellectual impulse or will and sensual impulse or appetite. Intellectual impulse was directed towards universal qualities, and towards what Kant would have called ideas of reason, like God, immortality, truth. Appetite was directed towards immediate sensitive good, like food or sex. Appetite gives rise to emotions of two kinds, concupiscible and irascible. Concupiscible emotions were those which involved their object as being something good in itself, like desire, satisfaction and

disappointment. Irascible emotions were those which related to their objects as providing difficulty, danger, support for an activity originally motivated by concupiscence; fear, anger, hope and despair are irascible emotions. In terms of the examples, (1) and (2) would be described in terms of concupiscible emotions, and (3) and (4), in terms of irascible. These emotions can become organised into habits, attitudes, and interests, and these more long-term dispositions can also be said to underly any particular manifestation of emotion, whether concupiscible or irascible, and whether the object originally pertains to will or appetite. Aquinas cannot locate aesthetic pleasure within reason for its object is clearly sensual and particular. Yet, it is clearly not a form of appetite. In the end, he locates it within neither division, but within what he calls 'the sensitive power', which serves both reason and appetite. The Thomist theory of perception, like many modern theories, sees perception as occurring at two levels, an initial, basic process of passive registration, and an active, synthetic process. The active process is called 'the sensitive power' and has its own dynamics separate, in the case of aesthetic perception at least, from the concupiscible and irascible emotions.

Translated into psychoanalytic terms, reason, insofar as it is ^{the} faculty of mind that determines the morally good, has given way to the superego,

internalised social norm. The appetites form the basis of the id, which together with these internalised controls constitutes the motivational base of our actions and experience. Concupiscible and irascible emotions correspond approximately to the functions of the id in providing instinct or energy directed towards the satisfaction of biological needs, and to the functions of ego in coming to grips with the world as it thwarts or enables the satisfaction of these needs. As in Thomism, habits and attitudes can be formed which serve these biological needs only indirectly if at all. Modern psychoanalysis allows the existence of ego-instincts, abilities and tendencies to acquire knowledge of the external world, to find significance in events and actions outside their immediate relevance to our needs and neuroses. These do not depend on the id for their energy, but are virtually autonomous. They are a more elaborate version of Aquinas's sensory powers.

The basic structure in Aquinas is very similar to that outlined at the end of the last chapter. There is a basic level of motivation and within this basic orientation towards action, there is or develops a set of structures, action schemata, aimed at satisfying these basic motivations against the world. These structures have their own autonomous dynamics, the irascible emotions. They also require knowledge of the world, i.e. sense knowledge. At first this is embedded in particular action, but eventually it becomes

autonomous, and a third level of structure develops. This too has its own autonomous dynamics, including aesthetic emotion. Both Freudian and Thomist theories are intellectualist-dualist. Thomism has its appetite/reason opposition, and psychoanalysis its pleasure/ conscience or id/ superego opposition. As regards value in general, Aquinas, as we know, has a complete new level of mind, with its own structures, motives and emotions, and with a completely different set of objects. This, of course, is a solution forced upon him by his inherited and orthodox dualism of flesh and spirit. That it is something of a forced solution can be seen by his evident reluctance to abandon entirely Aristotelian biological monism.

"Now the dependence of one power on another can be taken in two ways; according to the order of nature, forasmuch as perfect things are by their nature prior to imperfect things; and according to the order of generation and time; forasmuch as from being imperfect, a thing comes to be perfect. Thus according to the first kind of order among the powers, the intellectual powers are prior to the sensitive powers; wherefore they direct and command them. Likewise the sensitive powers are prior in this order to the powers of the nutritive soul.

In the second kind of order, it is the other way about. For the powers of the nutritive soul are prior by way of generation to the powers of the sensitive soul;

for which, therefore, they prepare the body. The same is to be said of the sensitive powers with regard to the intellectual."

We can see here a straining towards representing the mind as a single, unified organism, with each succeeding level a natural outgrowth of the previous levels as the organism develops a more and more refined and articulated adaptation to its environment. That is, we can see a tendency to produce a theory like that of Schelling or Macmurray. The same movement is apparent in psychoanalysis in the development from traditional Freudian theory to modern ego-analysis.

We can represent how these various ways of organising the phenomena relate to each other as in table (1).

TABLE 1

THOMIST	PSYCHO- ANALYTIC	MACMURRAY
Concupiscible emotions	Id	Motive Consc.
Irascible emotions	Ego	Action Consc.
Reason	Super- ego	
Sensitive power	Ego- instincts	Sensory Consc.

4.4 CONSTRUCTIVIST ACCOUNT of the RELATIONSHIP.

Earlier, it was suggested that the traditional sensationist account of perception could be more or less reduced to two propositions, enrichment and atomism. Corresponding to these, the account defended here has two opposing propositions. The first is about the application of schemata rather than unconscious inference, i.e. about the creative or constructive aspects of perception. The second is non-atomism, and means that the basic units of perception comprise a much richer range of things than simple points of coloured light.

Any cognitive act - any act, in fact, - is a mixture of two functions, accommodation and assimilation. Assimilation is the process by which we change the world to make it a part of our action. This may be at a physical level, as when we grasp and lift something soft, and it changes to fit our grasping it; or it may be at an intellectual level when we construe the world in a particular way because of the particular intellectual structures which we operate in doing so. Here, of course, it is not the actual material stuff of the world which changes, but our representation of it. The other side of the coin is accommodation. Reality is not infinitely malleable - not even at the cognitive

level; it also changes us when we come in contact with it. In the case of grasping and lifting, not only does the object change shape as we grasp it, but, and even more so, our grasp changes itself to meet the form of the object. This is accommodation. Similarly with cognitive acts, they must, in order to come to grips with reality at all, somehow adjust themselves to it. Now the function of a perceptual schema is the same as that of any other schema, to guide action. The acts involved here are exploratory acts. In the case of visual perception, these include orientation movements of the body and particularly of the head, eye movements, movements of accommodation and convergence, and they include acts which serve the same sorts of functions, but have no outward manifestations. All these diverse acts are acts of attention. Insofar as a particular incident of perception is largely assimilative, these acts of attention will be tightly controlled by a pre-existing schema, and we will be attending to such aspects of the world as that schema directs. That is attention will be concentrated or selective. Insofar as a particular incident is accommodation, there will be no such control, and we will be attending to many aspects of the world, creating a schema to embrace them all. Attention will be diffuse.

It is clear that our condition affects our experience. In cases like (1) and (3), this is partly a case of picking up different structural features -

different invariants in the stimulation -, but it is also partly a case of the same structural features having different affordances. Apart from this, as far as cases (1) to (5) go, the alternative theory is no better and no worse than the traditional one. In the one case a particular complex of feelings becomes associated with a particular set of impressions or sensations organised as a perception, and in the other a particular disposition to act in a certain way, with all the associated motivations and feelings, becomes associated with a particular sort of activity of the perceptual systems constituting a perception. In case (6), we have noted the grave difficulties confronting an empiricist account. We must now examine the constructivist account to see if it fares any better. Amodal and supersensuous perception seem to imply a super-sensory order. This notion of such an order has been defended by Hayek (1952), and plausible mechanisms for its detection have been proposed by E.J. Gibson (1967). Certainly, there is evidence which would tend to support this. Von Bekesy has shown the similarity, indeed confusability, between sensed vibration on the skin and hearing. One possible basis for such an order is that the special senses are the result of differentiation from one, original unitary sense. Of course, this differentiation would occur in evolution over a very long time scale, but Bower has suggested that a similar process occurs in individual development with infants initially responding to information in each modality as virtually identical. If

the modes of perception are treated as forms of sensibility, they have very little in common, and it is very difficult to see what the original sense might be. However, if we regard them all as forms of 'exploratory action', then active touch becomes an obvious prototype. How much simpler is the assumption that these adjectival, qualitative aspects of the situation are picked up directly from the stimulus flow in the same way as colour and movement, just as Gibson suggests. Of course, it is not denied that the use of these 'high level invariances' to specify particular sets of 'affordances' or particular 'valences' - the language is all Gibson's - is to some extent a function of experience. All that is required is that, as elements in our perception, components of our perception, these qualities are the product of operations performed on the proximal stimulation, and not on other hypothesised mental contents.

So far, the discussion has been about emotional aspects of perception; how the presentation of certain particular things to vision can result in an emotionally toned perception. That is, we have been talking about how structural features of perception relate to emotion. However, the relationship clearly works both ways. There are also cases where the internal state can affect the structure of the perception, as in the examples of case (8). Of course, it is not only dynamic aspects which have this effect, but structure also. Our everyday

knowledge about how the world is organised provides direction and coherence to our attention. This knowledge, whether organised as frames (Minsky, 1974) or scripts (Abelson, 1974) or whatever, functions as an organised pattern of expectancies. Expectancy or set can have much the same effect on perception as motivation. In any case, what we have is an extreme form of assimilation. Internally driven schemata are searching for support in the external world. In poor stimulus conditions, they are not disconfirmed; indeed, they find something which will do as support. In either case, a misperception occurs. Of course, these effects are compatible with the radical constructivist position taken here, and perhaps with none other.

4.5 AESTHETIC PERCEPTION and ACCOMMODATION.

The basic reason for the sensationist view of perception is phenomenological. Earlier, it was noted that any incident of perception has a particular object, but this object need not be the same across any two incidents, even in the presence of the same external stimulus. This is the case of seeing an aspect. Now, on switching from one aspect to another, something changes, and something remains the same. This leads to the notion that there are at least two levels of the visual experience, one of which is simply given, and one of which depends on our interpretation or organisation. Similarly, there is the experience of seeing in what might be called different 'modes'; we can see the same thing from moment to moment either in terms of light, shade, colour and form, or in terms of its structure and its identity as a member of a particular category having that structure. This is different from seeing an aspect in that these do not seem to be mutually exclusive, indeed the temptation is to identify these modes with the levels already mentioned. What is at issue is a change of emphasis; in one case attention is directed to the organisation, and in the other to the appearance, to what is simply given. The level which is simply given is equated with sensation by many psychologists who, like James (1890a), distinguish between a prior relatively

unembellished consciousness, and one which has been enriched by addition of memories and associations:

'Perception thus differs from sensation by the consciousness of farther facts associated with the object of sensation:'

and who links sensation with the world of childhood:

'Pure sensations can only be realised in the earliest days of life. They are all but impossible to adults with memories and stores of associations acquired.'

It is tempting to see this as some sort of primitive or naive perception. This is what is actually there in the light, how things actually appear and appeal to our senses. From this we must get to the world of objects in which we live and act. This is to be regretted. Much more to be regretted is that once we did this consciously and only to need, now we do so automatically. Once we lived in the pristine, immediate world of the senses, only leaving it now and then on short business trips into the world of affairs; now we have almost forgotten its existence. This view is common among artists and critics, who often, like Coleridge or Tolstoy, see the function of art as to restore us to this innocent seeing. Indeed, it can scarcely be denied that aesthetic experience has something to do with relating to the appearance of things. The question is

whether this bare appearance has anything to do with either sensations or childhood. It is possible to recognise the descriptions as capturing something real, and to accept that this mode of seeing is something of great value, without agreeing with the particular psychological model proposed. Indeed, Coleridge held onto this insight all through his life, but at one period he expressed it in the language of Associationism (after Hartley) and later on he espoused a theory derived, like the theory argued here, from Kant and Schelling.

The theory espoused here says that this aesthetic mode of perception is not a matter of a primitive form or earlier stage, but of the sort of attitude or motivation we bring to the situation. Attitudes and motivations act through what Kant calls, the empirical concepts of the understanding; that is through the system of categories which we have learned to apply to the world, and which are largely embodied in our ordinary language. After all, we take up a particular attitude to something as this or that particular type of thing. This mode of perception bypasses the category system. It is a sort of disinterested perception, where attention is distributed not according to any prejudice or purpose, but according to the requirements of a complete synthesis under a schema created for just that situation. It ought to be possible to produce in subjects, or have them produce in themselves, this sort

of relaxed, diffuse attention where the lower level perceptual processes are not driven by any particular schemata. One way might be to instruct them to use the whole resources of language to capture exactly and completely what is in front of them, i.e. to write a poem, and then to read the poems or interrogate them about their experience. This has not been done in any disciplined way. However, the results of thousands of natural experiments are available in anthologies of poetry, and there are many accounts of the experience by poets in work's like

Wordsworth's preface to the 'Lyrical Ballads', and Coleridge's 'Biographia Literaria'. These lend considerable support to the sort of phenomenological description given above. There is another strategy for disconnecting perceptual processes from the ongoing stream of action, affect and thought, and focussing attention on the "bare experience", and this is simply (although far from easily) to forgo language. This is the strategy in that area of research which has come to be known as the experimental study of meditation. However, it is perhaps worth recording that the phenomena in question were known of in more or less conventional psychology before the current interest arose. Indeed James (1890a) had a sophisticated taxonomy of attentional states, in which the one under discussion here was called 'active immediate sensorial attention'. In the studies by Deikman (1966), subjects were required to direct their attention onto a simple object, and keep

it there. When the mind wandered - as, of course, it often did - subjects were instructed simply to bring it back to the object. Subjects were asked to report their experiences. They reported in very similar terms to the description above. Deikman found that consistently, they reported increase in vividness and liv^eliness, 'de-differentiation of modalities', and the sort of feelings of freshness or discovery mentioned above.

In this mode we notice more, that is we notice things and aspects generally ignored; we notice more intensely, that is our perceptions have more life and energy; and we notice differently, that is we seem to be in a qualitatively different relationship to the objects of our perception.

(1) Colours are brighter, or rather the experience of colour is more intense; hues and tones are subtler, we make finer distinctions and appreciate their subtlety; we notice shadows, and how deep they are; we notice and revel in the quality of the light itself.

(2) We notice texture, things are seen as rough or smooth, and more than this we experience the significance of texture, things are seen as damp, slick or dry. We relate our seeing immediately to a sort of sensible reaction; we can feel things through our eyes as though touching them. There is a distinctly cross-modal feel to the experience, and this carries over into our emotions. Just as we would recoil from a particular sort of slimy touch, so we recoil from the

same quality presented visually.

(3) Form presents itself in new ways; it's almost as if it breaks up into aspects; solidity, delicacy, precariousness, and so on. Each of these aspects can call up an apparently appropriate response.

(4) Alongside the specific tactual, bodily and emotional responses mentioned, there are often more general responses of fascination or wonder.

This, of course, is a subjective, impressionistic account, and it may seem that theories cannot be constructed on the basis of this sort of observation, at least if they are to claim any sort of objectivity. Nevertheless, it will be argued that the account given above has a great deal of inter-subjective validity, and in the study of perception what more is there? However, sophisticated the methods everything comes down to reports of experience, or of judgements on experiences.

If perception is made up of sensations, it is at this level they ought to be evident. Now the aspects in the first category may bear some resemblance to the traditional sensations, and even in the second, the purely visual experience might still be related to fairly local events at the retina, but the aspects in the third category, at least, are surely not candidates for sense-data. At least, if they are this is a far cry from atomistic theories of sensation which see the basic constituents of perception as sort of infinitesimal quanta of coloured light. Now, this does not mean that

the basic constituents are not perceived in this mode. It is possible to distinguish analytically within this mode, as indeed was done here, a number of categories, and to say that one of these categories comprise the basic constituents, but this division is not present in the experience, and there would be no phenomenological justification for the claim. Phenomenological accounts ought, of course, to include not only what we experience, but what we do. What we do in this mode is nothing in particular, nothing other than looking at the world. Our normal mode of perception is very largely assimilative; that is we apply ready-made schemata to the world. This mode is primarily one of accommodation to the world; that is, of the construction and operation of perceptual schemata exactly adjusted to the world in all its concrete detail.

CHAPTER 5: The VISUAL PERCEPTION OF SPACE.

5.1 INTRODUCTION.

There are two relatively distinct notions of a model. The first is when we talk about a model boat or car. Here, the model bears a close physical resemblance to the original. It has the same parts, perhaps, in the same physical relationships. If it is a working model, these parts may perform the same sort of operations in both cases, the only differences being of scale and/or material. It not only looks the same, it behaves the same. The other idea of a model is when we talk about modelling the behaviour of an oilfield or a spaceship mathematically. Such a mathematical model might, of course, be implemented on a computer, and here we should talk quite naturally about a computer model. In any case, there is, naturally, no question of any physical resemblance. Nor is there any question of any behavioural similarity; the operations going on in a computer are not at all like those going on in a section of the earth's crust, or in the interior of a spaceship. However, when it comes to computer models of behaviour, particularly mental behaviour, the relationship may not be so clear. Of course, there is still no possibility of a physical resemblance between the model and the

original, but there may be a possibility of a behavioural resemblance. That is, a successful computer model of a particular sort of mental behaviour may be construed, rightly or wrongly, as not only producing the same results as the original mental behaviour, but as performing the same operations. It is quite clear that some models have been understood in this way (e.g. Winograd, 1972; Anderson and Bower, 1970). The relationship might work both ways; if computers are like humans, humans are like computers, and their behaviour can be expressed in terms of information storage, transformation, and retrieval (e.g. Posner, 1973), or levels of processing (Craik and Lockhart, 1972), or of strategies and programs (Newell et al, op cit). It is not denied that this has a certain validity for certain aspects of mental behaviour, those aspects that might be called structural or procedural. Even here, it is necessary to be careful about the precise relationship between model and reality, and some of the possible relations are discussed in the next section. However, the point here is that mental behaviour, or mental acts, as is often more appropriate, are always more than mere procedures. They include aspects of what was referred to as 'spontaneity'. Now motivational processes and decision processes can be modelled mathematically. Indeed, there is a whole branch of mathematics dedicated to this, game theory, which has been applied successfully to behaviour in animals at least (e.g. Maynard-Smith, 1976). Needless to say, these models can be implemented on a computer, but they would be models in the second

'weak' sense. Of course, hybrid models are possible, where the procedural aspects might be construed plausibly as models in the strong sense, but they would be hybrids.

Sometimes, the claim is made that consciousness is merely a matter of structural complexity. A piece of human behaviour is modelled on a computer, and the model is treated as being similar in all respects to the original. Of course, it is never claimed that this or that particular computer operating this or that particular model is conscious, but this is very often seen as a matter of complexity. Once really complex aspects of human behaviour are modelled, perhaps by some form of hierarchical multi-processor system, we will have no reason to deny that the system is conscious. This is a result of the intellectualist tradition which sees cognitions, perceptions, emotions as different forms of consciousness following each other from moment to moment. Perhaps, emotional consciousness remains a mystery, but we are well on the way to producing cognitive consciousness. The action based approach used here shows this to be a nonsense. Thinking, remembering, feeling are not different types, but different aspects of consciousness. With this in mind, we shall try to say something in information-processing terms about structural aspects of the model being advocated.

5.2 AN OUTLINE MODEL.

Action takes place in space and involves other physical bodies. Normally, it is guided by vision, and the space and the bodies are constructed by vision. Of course, this is not always so; it may be guided by touch, or the space and bodies may be constructed by touch. In this latter case, as we have seen, the constructive element is more obvious. This ability to construct a world on the basis of information from the senses is one mode of operation of a more general image making facility which also operates when we construct images in the absence of any environmental stimulation. Of course, what is meant here is that both visual imagery and visual perception involve the same sort of activities, but it may be of some interest that there are definite indications that they employ the same hardware (Brooks, 1968). In any case, this means that a perception is as much a creation as an image in a daydream. Of course, it corresponds more or less exactly to the world, but there is no contradiction here. All actions are simultaneously constrained and supported by their environment, and to the extent that they are constrained, they reflect its structure. Also, they are directed by their goals, and the goal of this particular sort of action is to represent the environment.

The images can be understood as consisting of three levels; structure of parts, organisation of space and sensible material. The highest level of structure of parts can be expressed in terms of a system comprising a set of elements with rules for their permissible combinations. This maps directly onto the conceptual system, providing a bridge between perception and thought - the traditional function of imagination in philosophy. The rules generate structural descriptions of the sort familiar from linguistics in general, and TGG in particular, i.e. immediate constituent structure or phrase structure. This sort of structure is usually expressed in terms of a tree diagram with branching nodes terminating in ultimate constituents. The ultimate constituents are drawn from a set of primitive features which are not capable of further analysis at the same level, but are capable of realisation at a lower level. Of course, in most linguistic systems only terminal items have such realisations, whereas here (see fig 1) all items may have them.

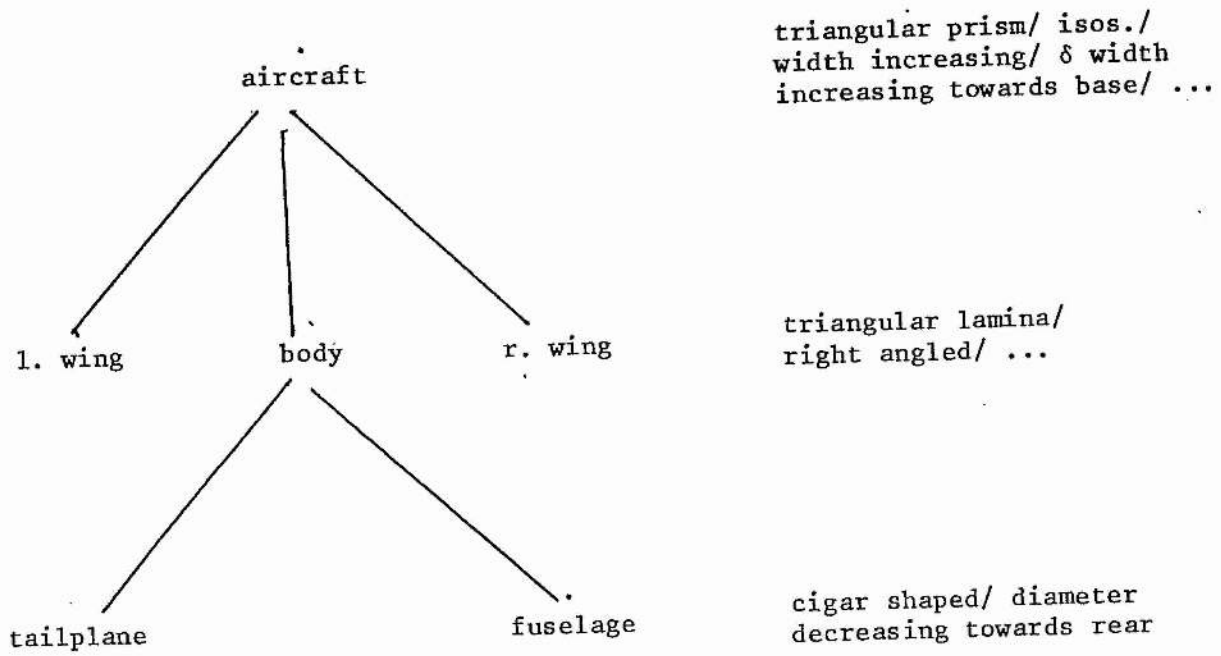


Figure 1

There are many problems involved in the construction of such a system, the most obvious, perhaps, having to do with departures from the norm, missing parts, and with the more general problem of context dependency. However, it seems likely that these can be solved. Already, several systems of this type exist either as a working program for a restricted range of objects (Winograd, 1972), or as a proposal intended to apply to all possible objects (Miller and Johnson-Laird, 1977).

At the spatial level, images are structured sets of affordances for action, usually instrumental action. This is in contrast to a view which says that we see originally the projection of objects, and that we interpret these projections in terms of surfaces, edges, protruberances. Of course, projective geometry does describe the light falling at the eye, and, of course, this light does cause changes in the retina which trigger off various other processes in the nervous system. The point is that these are physiological processes, not mental acts. We need perform no operations to get from a primary perception to an enriched, interpreted, humanly significant perception. This, of course, is Gibson's theme slightly restated. In a sense, Gibson is merely paraphrasing Kant. The primary consciousness is objective; the secondary, reflective, may be sensational. In another sense, he is an improvement, for Kant was intellectualist in his

approach rather than pragmatic, and saw objects as members of categories of the understanding, whereas Gibson sees them as manipulable things.

This level of organisation in space can be represented in much the same way as the level above. Of course, here we are concerned not with parts in a spatial relationship, but with aspects in a logical relationship. Here the terminal items correspond to sensible features of the world. These include shapes, colours, slants, orientations, and so on. Systems of this sort have been described in outline for pictures (e.g. Clowes, 1969) and for real objects (Marr and Nishihara, 1976). Marr's system of generalised cones is particularly interesting, since it represents an advance over more intellectualist/ analytical approaches in that it makes some attempt to represent the actual physical presence of the object.

Structure is, in some sense, arbitrary or conventional; shape is not. It has an immediate, obvious objectivity which derives from the fact that we are material bodies among others, and if we do not 'correctly' perceive space and the bodies filling it, we come up against the world with a bump. When we see the world it is always organised in some way, and there can be several possible organisations of the same spatial configuration. There need be no level of pure, unorganised, spatial perception, however, although such

a description of the world might still be valid as an object of reflection. Shape is an abstraction, a description of what these several organisations have in common. This after all is the position with regard to atomic sensations. Wittgenstein insists that this is not the case; that it is simply wrong to associate organisation and shape as aspects of perception. He says that when the organisation changes, something remains the same, and that this something includes shape. By shape remaining the same, he means that if he were to stretch out and touch various points of the object he would do the same before and after the change. However, he has misled himself by considering picture-objects, rather than objects proper. Gibson notwithstanding, there are times when the information in the light does not uniquely and certainly specify a particular three-dimensional spatial layout. In this case, we may form a non-veridical perception. When cues become available which falsify this, a change to a different, this time veridical, perception occurs. Particular identified points of objects or surfaces will then be located at different points in space, in the sense that I would make different movements to touch them. The Ames room experiments offer laboratory examples of this, but it also occurs outside the laboratory, especially in conditions of restricted visibility, such as mist.

At this level there is a complementary way of seeing concerned with our awareness of space,

particularly the space we move in. Most perception is perception of things, or rather, most talk about perception is about perception of things. Yet we are immediately aware of space, how it is filled and where we are in it and how we are moving in it in relation to obstacles, gaps and supports. We are immediately aware of what our immediate environment affords to us in the way of actions. At least as regards whole body actions, this does not involve any detailed parsing of the forms, indeed quite the reverse as when we describe a curved path past a number of obstacles. It is often claimed that we see bodies and not the spaces between them, but, at this level, the opposite seems to be the case. What we see is space, sometimes opening up, sometimes closing, sometimes curving or bending off to one side. We are scarcely conscious of the bodies, certainly not of their articulation. Where we see them, it is as surfaces, boundaries of space, the limits and the supports of our actions. This is the sort of perception Gibson describes when he is talking about visual perception and the control of locomotion. This is not so much a level as an alternative mode of perception, perhaps even related to a different visual system (Trevarthen, 1970).

Still at this spatial level, there is a third, rather peculiar, way of seeing. We discussed earlier the change that occurs when a non-veridical perception of space is corrected by the availability of new

information. Something remains the same during and after the change. The world seems to alter shape, yet nothing in the actual appearance of things seems to alter. We should describe the world differently after, but we should describe the impression it makes on us in exactly the same terms. Of course, this is because the actual contours as they slope towards or away from each other remain the same. The scene affords exactly the same as before for eye movements. It is tempting to give these visual contours special status, but this would be a mistake. Voluntary eye movements, accommodation and vergence movements normally work together. Take the case of an edge receding from the observer. The eyes may follow the edge; as they do eye movements will be made to take account of how the edge projects onto the fronto-parallel plane, and accommodation and vergence movements will be made to take account of how the visual information changes as the edge recedes in the depth plane. Accommodation and vergence movements relate to aspects of the stimulus - clarity and binocular disparity - just as eye movements relate to contour; and accommodation and vergence movements provide depth information, just as eye movements provide depth, direction and elevation. What specifies form is the sort of exploratory action it will support. This action occurs in three dimensions, two of them accounted for by voluntary eye-movements and the third by voluntary eye movements plus accommodation and vergence movements. We can see this in the sort of 'hunting' that occurs in the

accommodation system as the change occurs, and, of course, in the fact that this sort of situation occurs mainly in mist when this system is confused by the lack of sharp images.

We can, of course, direct our attention to this set of affordances for voluntary eye movements. We can put ourselves in that peculiar frame^{of} mind where, as Gibson puts it, we are looking at the visual field rather than the visual world. In certain circumstances, this will be equivalent to seeing a 2D picture. The traditional view is that the material in visual perception does not correspond to the distal stimulus, the actual object perceived, but to the proximal stimulus, the pattern of events in the flux of energy at the receptor surface. Here, it seems, we are conscious of just that, or of something rather close, perhaps cleaned up just a little by lateral inhibition and suchlike. However, phenomenologically, it is simply not true that we first experience a 2D display, a display without depth and, therefore, without size constancy. It is difficult to see without size constancy, and in many circumstances impossible. Take the case where an observer is looking at a vertical book in a bookcase about eight or nine feet away; the book is of A4 size, more or less. In front of the observer, eight or nine inches away and lying horizontal is a sheet of A4 paper. When he looks at the spine of the book, he can still see the paper. It is impossible to see them as the paper being twelve

times the size of the book. If they are put in the same plane, and especially if they are also placed so as to project onto adjacent areas of the retina, one can see without size constancy, maybe. It is only because most constancy experiments are conducted under conditions that approximate to this second condition that the notion we can overcome size constancy has any plausibility whatsoever. The truth is that this is a very sophisticated, highly analytical mode of seeing. Nor is it seeing without a third dimension. What happens is that everything is flattened onto a picture plane, but that plane is still at some particular depth.

The term "sensation" is used in a number of ways. One definition is that it is the subjective pole of our experience. If we run our fingers over an object, normally, what we experience is the object. However, we can turn our minds to the feel of our skin, the pressure and the indentation. Certainly, this has something to do with the pattern of events at the surface of the sense organ. However, it does not bear the same relationship to the final objective perception as traditional accounts would have us believe. This can be demonstrated by a relatively simple experiment taking advantage of the fact that wedge prisms impose curvature on the stimulus as well as displacing it. If a straight vertical edge is inspected while wearing wedge prisms it will be seen as curved. If, while looking at this curved display, a subject runs a finger along the edge, the

edge will be felt as curved. The explanation of this effect is in terms of the visual perception determining the efference applied to the finger to keep it in contact with the edge, and the felt shape of the edge depending on this pattern of efference. At any rate, it does not depend on the afference from pressure sense, or position sense.

In active touch our hands are moving, the situation is changing from moment to moment. We have a choice, either to attend to the sensations or to the object. Once the events have passed away, we cannot change the choice for these events. In vision the situation is rather different, at least for static displays. We can look at the same display, and we can concentrate first on the content, and then on the impression it makes on us. The notion that in this state we are experiencing some first level of perceptual processing has given rise to a number of characterisations of this first level. The most obvious are the impressions of Hume or the primitive sensory unities of Hebb (1949). This sort of theory is currently undergoing a revival both in the form of icons (Sperling, 1960; Neisser, 1967), and primal sketches (Marr, 1974). However, as we have seen, the idea of a two-dimensional imprint does not match our ordinary experience. In any case, such theories do not fit the experimental facts on the occurrence of motivated misperceptions (see chapter 3). Impressions allow too little room for negotiation. The same is true

of Gestalt fields. Although they are not, by any means, replicas of the proximal stimulus, the field is determined entirely by the stimulus, and the organisation is determined entirely by the configuration of the field.

In vision, also, we can recall an image. When we do this, we get the impression that it is present to us at all levels including the sensible material. This is not true of touch where (see chapter 3) the sensible material bears a rather different relationship to the perception. We feel we can re-examine the visual image, re-analyse it. This is, perhaps, the root of the notion of atomic sensations. However, there is no reason at all to suppose that these theoretical objects, objects of reflection, should be in any way similar to the objects of our experience in a non-reflective mode.

The theory advocated here depends on Gibson's invariants. It is, broadly, that there is no icon or primal sketch for higher level processes to interrogate or interpret. What is interpreted or interrogated is not something in the head, but the world. What is meant by sensible material is the patterns of invariance, no matter how complex. That is, a single spot of light signifying a single spot of light, a texture gradient signifying depth, or a particular pattern of movement signifying depth are all at the same level, the level of sensible material. However, this level is not just

passive material; it is like the other levels a schema, a plan for action. In this case, the actions are exploratory actions, eye movements and the like. This level is a part of our seeing; it is not just something upon which our seeing is consequent, like events at the retina, for instance. There is a tendency in information processing accounts to represent levels such that information is passed from one to the other, and then finally some reduced, transformed or elaborated version is allowed to enter consciousness. In some of these stage models the result would seem to be our hearing rather than seeing the visual world (e.g. Haber and Hershenov, 1973), or at perhaps merely intuiting the identity of the objects with which we are confronted. Each of the levels must exhibit transparency to the ones below it, so that they all enter into our perception right down to this final level where the actual sensible qualities are apparent.

The image is related to the actual flux of stimulation as a schema imposing cohesion and organisation on it, but also as an hypothesis which the actual pattern of stimulation may confirm or disconfirm. Specific features of the image are realised as particular spatial and temporal patterns in the light falling at the eye. These features combine - under the control of rather general schemata of space, the object, etc. - and suggest or determine the image, missing features being provided from memory. This image guides

the production and extraction of other patterns, other features. The image is a plan then, for the performance of exploratory actions, eye movements, shifts of attention (c.f. Neisser's 1976 perceptual cycles). Sometimes the information required to confirm the hypothesis is not there. This can occur in two situations; a simple lack of information, due perhaps to bad light or brief exposure; or the presence of disconfirming information. In the first case the image is imposed on the incomplete stimulus - this is how we see bushes as wild animals or footpads in the dark, or a tachistoscopically presented red two of spades as black (Bruner and Postman, 1949). The case of disconfirming evidence is more complex. Either the information is accepted and the image accommodates to it, but retains its identity - we see a car with triangular wheels. If the discrepancy is too great, we get a new image, a new organisation - everyone is familiar with the situation where two organisations of the same sensible material vie with each other for a moment or two before one is preferred. Where accommodation occurs, it need not be complete, especially if the stimulus is in some way inadequate. Here, the result is a compromise perception, a brown two of spades, or one that is black with red borders (Bruner and Postman, op cit). Of course, discrepant information may be there, but simply not extracted, and this corresponds to the first situation, absence of information.

When we see, all levels are involved. There is always structure, always form, and always sensory material. The structure may be minimal, as in a single simple form, the space may be reduced to two dimensions, and the colour and light and shade restricted to a simple black against white. But to look at a black form on a white field is, nevertheless, to see in a way that is completely described only in terms of structure, form and sensory quality. This can be seen in Wittgenstein's triangle, a simple plane figure which he is able to use as an example in a discussion of all these levels. The structure may be just an inventory of items, each one no more related to any of the particular item than to any of the others, no conglomeration into groups and higher order groups. Something of the effect can be seen in a Breugel painting where although first order groups are sometimes formed the structure is very flat, practically non-existent, with no levels of organisation between the primary groups or individuals and the picture as a whole. This is a very unnatural organisation, difficult to achieve in perception, and almost impossible to maintain. There is a natural tendency to group either on the basis of purely physical aspects of the situation such as proximity or (physical) similarity, or on the basis of the identity and meaning of the items. This is related to the span of apprehension. Seeing is a cognitive operation, involves processing of information, and is subject to limitations on channel capacity and the like. We have a certain fixed capacity and so must

break up the world into chunks. We handle each one of these chunks separately, grasp each, come to know each as a unit. Then we can take their internal structure for granted, and use them as items in larger chunks. The bits and chunks are, of course, not as arbitrary or as abstract as information theory accounts would have it. For our cognition, our knowledge of the world is not primarily abstract, but concrete, not primarily for reflection, but for action. We could, of course, design a perceptual system whose basic units were simple two-valued switches, and for which any organisation of these, whether good for merely theoretical purposes, for practical purposes, or no good at all, was as easily handled as any other. But, it would not be a human, or even a biological system.

We shall call patches of light, shade and colour, contours, textures, and so on, sensible features, and the values they take in a percept, sensory features. Generally, our perception corresponds more or less exactly to the world. We do sometimes misperceive, however, and this is more than to misidentify on the basis of an incomplete or fragmented perception. A misperception is a complete and unified something which corresponds in every way to a proper perception, except that it turns out to be wrong. It has all levels, transparent to each other, right down to sensory features, and these need not correspond to any event at the receptor surface - this is the case in one type of

misperception. The only way this can be so is for these sensory features to correspond to output processes in the CNS. Clearly, there is more to it than that, or our perceptions would only correspond to the world by the most unlikely of coincidences. The suggestion is that this lowest level should be realised as a set of parallel processes each of which is a sort of hypothetical statement, a conditional of the sort

if x then O u y

with x a particular conscious content, and y one significant pattern of light from among a limited set of such significant patterns of light at the eye. O is the set of all non-significant patterns of light. If this conditional is satisfied, perception x takes place; if it is not, perception x does not occur. Importantly, x may be a simple thing such as a spot of coloured light at a particular point in the visual field, or a more complex thing like movement or angularity. There is, of course, no doubt that the visual system can extract movement before, and independantly of, translocation of a particular object in visual space, and recent work suggesting that some sort of fourier analysis is performed on the light falling at the retina offers a plausible mechanism for the extraction of other sorts of 'high-level invariant'. In any case, such a process would obviously function to provide completion over the blind spot, and even out various other anomalies. Of course, at this lowest level the hypothesis is tested, not against the contents of another level, but against

the pattern of light falling at the retina, the light reflected from surfaces in the world. This has an important consequence. Since these surfaces are not generally transparent, some limitation obtains on what aspects of the hypothesis can be validated, what aspects can be fleshed out with actual material. This is why we do not see, yet in some way our seeing seems to specify at least rather vaguely, the backs of objects in our visual field, and this is why we do not see, yet in some sense they are still part of our perception, objects out to the side or round the back of our head.

The system as described so far allows top-down processing to occur and its products to be validated against the external world. Needless to say, we must also allow information to flow bottom-up. Without bottom-up processing our seeing would break down very quickly when the situation changed suddenly or unpredictably, we could see only what we might reasonably expect. Moreover, the system could never get off the ground in the first place. Perhaps the most obvious model would be to allow the conditional

if x then $0 \cup y$

to be replaced by a bi-conditional

iff x then $0 \cup y$

This clearly will not do as it stands, since it would result in every non-significant pattern of light - like a ganzfeld, or that caused by shutting one's eyes - triggering off a welter of perceptions unrelated to

the actual situation, but indistinguishable from ordinary, veridical perception. However, a slight change to

(if x then $0 \cup y$) \cup (if y then x)

will produce the desired results. That is, each feature at the lowest level is triggered either by the demands of a higher level, or an appropriate pattern of stimulation.

There is a problem with the sort of bottom-up processing discussed above. It locks our perception too firmly to the world. It makes the perception at any moment a function of the sensible material of the perception at that moment. However, there are a number of events that take place on a relatively long time-scale, yet contribute to the perception at any instant, motion parallax, for instance. Moreover, it makes the occurrence in the perception of any sensory feature the inevitable result of the occurrence in the light of an appropriate cue for it. This is just not the case. We can be conscious of some event, say, a shadow which allows us to infer a second event, say, a slope of a surface. The first event might be of the sort which would, in other circumstances, produce the percept of the second event. Nevertheless, we do not necessarily see the second event. What is required, then, is some sort of gap between the world, and our perception of it. This gap is provided by the fact that it is the output processes which correspond to our conscious experience

of the object. These do not need constant environmental support. Indeed, they need simply not to be disconfirmed.

Let X be a set of features making up our perception, and x any single feature. Z is the corresponding set in the real world, and z is any feature for which there is a corresponding x . y is an optical event in the causal chain;

$$z \text{ -- } y \text{ -- } x$$

We can represent the system as in figure (2).

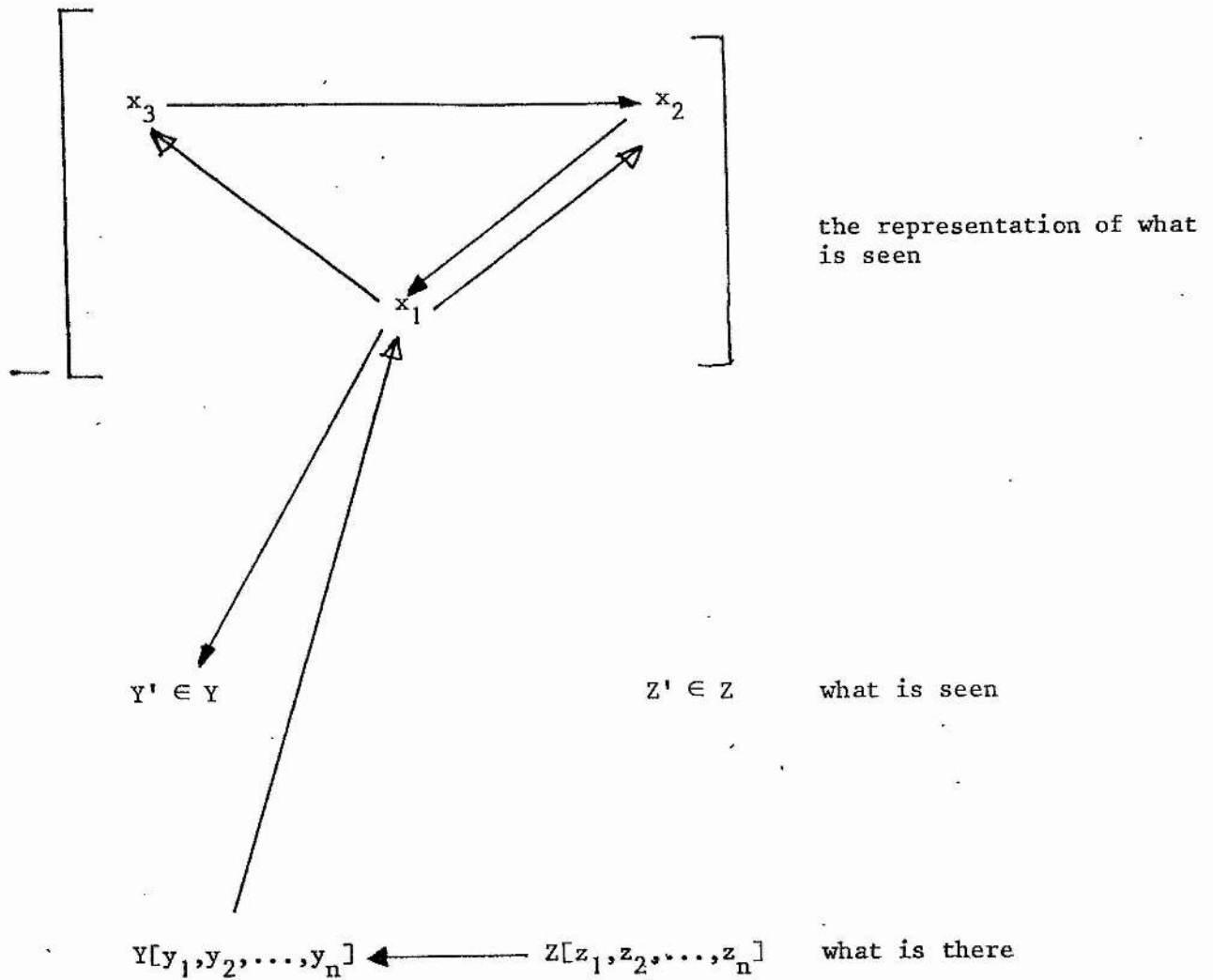


Figure 2

Consider the relationship between levels 1 and 2. As we go down the hierarchy, something is added; the description is more full. At least, the description is more full in perceptual terms, for of course level 1 ties into the whole system of scientific, historical knowledge. However, as we go from level 2 to level 3 nothing is added; indeed, the amount of information is less. The extra information in level 2 is organisation, and is contributed by the self. However, it does not necessarily depend on memory, at least not on propositional, categorial, potentially conscious memory, but is related to our ability to move in space, and to manipulate objects. Our visual experience can be understood in two parts, half pure perception and half a mixture of perception and thought. The core of visual experience is our experience of space, and here the two halves come together. They are complementary in the sense that together they provide for a visual world that is, at the same time, the world we move around in, the world we manipulate, and the world we think and talk about. In one sense, level 2 is relatively independent of level 3. The same spatial layout can be specified by a large number of sets of invariants. Also, if level 2 changes, as new information becomes available to correct a misperception, for instance, many of the features will remain the same. In this sense it is like organisation, but very much less subject to the will. Levels 1 and 3 both relate away from perception, level 1 to the inner

world of thought and memory, and level 3 to the actual physical 'feel' of things out there, but, at the same time to motivation and emotion, and, therefore, back to level 4.

So the visual system consists of a hierarchy of processes, each level consisting of an hypothesis expressed as a procedure for validating itself against the content of the next level down. There have, of course, been many previous models which involved hypothesis-testing (e.g. Bruner, 1957; Neisser, 1967), and even models which have seen the image (either the 'mental image' or the image in perception) as the 'anticipatory schema' which simultaneously provides the perceptual hypothesis and the perception (Neisser, 1976, 1978). However, they have, in general, insisted that the bottom level was different, that it was in some sense more 'actually there'. This sort of half-way house does not deliver us from intellectualism and dualism. Only a whole hearted radical constructivism can do that. That is what is proposed here, and what we will attempt to support in the next chapter.

CHAPTER 6: EXPERIMENTAL EVIDENCE.

6.1 INTRODUCTION

Till now, the concern has been to trace the history of a number of ideas, such as imagination, action schema, the relation between bodily action and visual perception, to relate these ideas, and to articulate them in a way more familiar to modern psychology. Sometimes it has seemed appropriate to refer to modern work to elucidate or support what was being proposed. However, it can not be claimed, on this informal basis alone, that modern psychological experimentation supports the view outlined here. Much of what has been said about the influence of thought and imagination on visual perception is uncontroversial. Most perceptual theorists have made use of the ideas of organisation and of different levels of the visual experience. The notable exception is Gibson (ops cit). Also the idea of perception as involving activity is now more or less accepted. Nor is there anything special about linking these ideas of organisation and activity; the way we distribute our attention has always been seen as the major determinant of the organisation we impose on the visual field. Moreover, the case for the visual image as a schema for this sort of activity is increasingly

recognised (e.g. Neisser, 1976). What is, perhaps, more controversial is the way these ideas have been put together, and in particular the way they have been applied to more or less do away with the idea of a lowest level of merely sensory awareness, or to make this lowest level the same sort of stuff as the others. There are, of course, those, like Gibson, who do not believe in sensation as a level of perception, but then neither do they believe in organisation and images. Those who believe in organisation and images have generally believed in some level of sensation or visual impression which is qualitatively different from what is built on top (e.g. Hebb, op cit) Of course, if the lowest level is not different, then it must be an action schema. If it is an action schema, then an alteration in the relationship between action performed and result must result in either a disruption of perception or a change in the schema, that is a change in experience.

6.2 VISUAL ADAPTATION TO OPTICAL RE-ARRANGEMENT AS THE FORMATION OF NEW SCHEMATA.

Various transformations in the array of light falling at the eye may be accomplished by the use of optical devices such as prisms and mirrors. It has been known, since Helmholtz, at least, that some sort of adaptation was possible to certain of these transformations. The range of transformations examined includes inversion, reversal, displacement and changes of form. The results indicate that behavioural adaptation at least is possible for any law-abiding transformation; this class of transformations are known as re-arrangements. Where the relationship between proximal and distal stimulus is not just altered, but destroyed, say by the application of a continually varying prism, no adaptation is possible; this class of transformations are known as dis-arrangements. Although some sort of adaptation occurs to all re-arrangements, it may be that there are different degrees or types of adaptation, or different mechanisms underlying the adaptation, for different transformations, or for different stages of adaptation to the same transformation. Certainly, it is necessary to distinguish between behavioural adaptation and perceptual adaptation. Also, it is important to note that not all transformations provide conditions for discriminating between these different forms of

adaptation. For instance while inversion of the visual field provides both behavioural and perceptual disruption, displacement of the visual field laterally provides only the former, since the altered stimulus is in itself in no way odd, but merely seems to come from somewhere in the world which it does not.

One of the earliest experiments, and certainly the most famous, was carried out by Stratton at the end of the last century. He wore an optical arrangement which both inverted and left-right reversed the visual world, and which, incidentally, reduced his vision to about seventeen degrees of visual angle from only one eye. He performed several experiments, each conducted over a period of several days during which he wore the device all the time his eyes were open and uncovered, i.e. during the experimental periods he received no un-re-arranged stimulation. He continued, insofar as was possible, with his ordinary active life, moving around, writing, riding his bicycle..What is clear is that after some time he achieved a very high degree of behavioural adaptation or re-adjustment. Also, it is clear that the world came once more to look, or at least to seem normal, at any rate, as long as he did not adopt an over analytical attitude. However, when specifically asked to attend to his seeing, to analyse and report upon the details of his visual experience, it was also clear that, long after this feeling of familiarity and harmony had been re-established, there was still something that

was different about his visual experience. It is easy, indeed tempting, to suppose that what remained different was the actual visual perception. However, Stratton gives some reason to suppose that, eventually, even this component normalised, at least some of the time, and the whole experience became virtually identical with before donning the device. The existence of genuine perceptual adaptation is made somewhat plausible by the observations, firstly, that conscious corrections led to mistakes, and, secondly, that on removing the goggles there was what seemed to be a genuine perceptual after-effect. So, we can sum up the results of Stratton's studies as follows:

- (1) Immediately on donning the device;
 - (A) Behavioural effects;
 - (i) The subject loses sensori-motor co-ordination.
 - (B) Experiential effects;

The subject feels that his visual experience has changed. Analytically, this can be broken down into two components.

- (i) A feeling that the world looks strange and unfamiliar, and that perception of it is fragmented and disharmonious.
- (ii) Things look different, the actual appearance, as distinct from the attitude to the appearance as either strange or familiar, is different.

There is no evidence that subjects make the distinction between these two changes spontaneously.

- (2) After adaptation.

(A) Behavioural effects. After some while subject achieves a high degree of re-adjustment as described earlier.

(B) Experiential effects.

(i) General. After some while, perhaps slightly longer than it takes to adjust behaviourally, subjects adjust in the sense that they no longer feel the world to be strange or different. Any differences there might be are no longer at the centre of their awareness. This is as if one were to start to see things as covered in pink polka dots. At first things would look strange, then the strangeness would go, but this is not the same as if the polka dots were to disappear. At this stage if the subject is asked specifically if he is seeing things upside down or right way up, he becomes confused, is not always able to answer coherently, but it becomes obvious that things are still in some sense different, although the subject was not aware of this until challenged.

(ii) Perceptual. Eventually, complete adaptation occurs, at least for some things, some of the time.

(3) On removal.

(A) Behavioural.

Immediately on removal sensori-motor co-ordination breaks down.

(B) Experiential.

(i) General. Subjects experience a shock of recognition.

(ii) Perceptual. If the device has been worn for a considerable period of time, and something like genuine perceptual adaptation has occurred, there is an

after-effect; things, or the self - the reports are ambiguous on this point - appear for a short time to be upside down.

There are several theories current purporting to explain adaptation to re-arrangement of the visual field. It would be nice if they were all candidates intended to make sense of the same agreed range of phenomena, but this, of course, is not the case. Theories which place adaptation at the motor end of the system, or in the sensori-motor hookup, tend to stress the behavioural effects, while theories which say that adaptation occurs within the perceptual system stress the perceptual effects. These theories are not, then, mutually exclusive, since those who hold that proper perceptual adaptation does take place, and hold, moreover, that the explanation of this adaptation is to be found within the perceptual system, do not necessarily deny that prior to, and perhaps independently of, perceptual adaptation, there occurs some sort of behavioural adaptation, and that the explanation for this is to be sought elsewhere. Accordingly, these theories should be considered not necessarily as alternatives, but as contributions to a more general theory.

In the early 1950s the prevailing zeitgeist was still that of behaviourism and the tendency was to explain adaptation in terms of operant learning

involving trial, error and (purposive) correction e.g. Snyder and Pronko (1952). Much evidence had been produced which tended to support this view, including evidence for savings on re-learning (Petersen and Petersen, 1938; Snyder and Pronko, op cit), and for task specificity (Snyder and Pronko, op cit). However, it was known that performance was disrupted after removal of the re-arranging device, which is hard to understand within a straight motor learning account since there should have been enough cue-specificity to keep the normal and adapted behaviours intact, differentiated and attached to their respective contexts. However, Kohler (1964), reporting a large number of experiments conducted by Erismann and himself at Innsbruck, propounded a theory of genuine perceptual change following on from behavioural change established by motor learning. This idea was developed into a formal theory by Taylor (1962).

Held (1955) produced a problem for the Kohler/Taylor sort of account. He reported an experiment on adaptation to auditory re-arrangement which did not seem amenable to this sort of explanation. Certainly, all direct error feedback was denied and no conscious, purposive correction took place. Held and Gottlieb (1958) produced an experimental setup to discover whether the same sort of adaptation without error feedback was possible with visual re-arrangements. The apparatus consisted of a prism device which laterally

displaced the visual world some known amount. The subject had to perform various tasks without error feedback e.g. the subject in a pointing task did not know when he had hit the target. However, the final position of the hand was visible. Subject head movement was prevented. The results were that adaptation did occur. A second experiment (Held and Hein, 1958) with the same setup was designed to test the role of active versus passive hand movement in adaptation. It was found that no adaptation occurred when subject's hand was moved passively. Held made sense of these results in terms of a model derived from von Holst's (1954) solution to the problem of stability in the visual world, the so-called re-afference model. Re-afference is stimulation from the external senses caused by the subject's own (voluntary) motion, the changes in the optic array caused by turning the head or eyes, for instance. The model involves producing an expected re-afferent signal. This is done by means of a copy of the motor command or plan - the efferent copy - which accesses a memory or correlation store to produce a copy of the re-afference previously produced by that particular pattern of movement. This re-afference copy is compared to the actual re-afference. If there is a match normal perception occurs, if there is not something is strange about the perception, but note that adaptation does not depend upon the results of this comparison. Adaptation occurs by the entering of the new efference/re-afference correlation. The crucial features

of the model are;

- (1) the site of adaptation,
- (2) the role of active movement,
- (3) the irrelevance of feedback.

Howard and Templeton (1966) agree with Held as to the locus of adaptation, but disagree with the two other crucial features of the model. They point out that without feedback (Held's condition) subjects never achieve full adaptation, while in other experimental setups, they do. They argue that adaptation is possible with passive movement, provided feedback of results and an opportunity for conscious correction is given. The experiments quoted (Howard and Templeton, 1966 pp 386 - 390) make it quite clear that what is being studied here is trial and error learning. It seems to be the case, however, that this learning causes rather than constitutes adaptation. This would be very close to Kohler's position, and, indeed, the phases of adaptation from conscious correction to fully automatic are discussed in virtually the same terms. However, what is learned, or rather what changes or adapts subsequent to learning, is different in each case. Finally, they show that other types of ex-afference may be used to produce adaptation in the absence of either active movement with or without re-afference or passive movement of effector organs. The experiment here (Howard and Templeton, 1965) consists of fixing an observer in an optical system such that the visual world is displaced laterally. No head

movement, indeed, no movement of any sort is permitted. A rod approaches the subject and strikes him on the lips. According to the visual input, of course, the rod should miss by the amount the world is displaced. Adaptation occurs as measured by manual pointing at a visual target, although the adaptation was by no means complete. Their theory depends, then, on informational discrepancy irrespective, more or less, of the source of that discrepant information.

A theory that might be seen as lying somewhere between motor theories and central switchboard theories was proposed by Harris (1963). Harris adapted his subjects to wedge prisms causing lateral displacement of the visual world. They adapted by pointing to visual targets 'straight ahead' with information available on both the final position of the hand and its relationship to the target. Thus, subjects quickly achieved a considerable degree of adaptation. Subjects were tested for inter-modal (visual to aural), inter-manual, and inter-task (pointing at different targets than those to which they adapted) transfer. Harris argued that proper perceptual adaptation should cause inter-manual transfer. No such transfer occurred, and, accordingly, he ruled out the perceptual system as the site of adaptation. He also argued that if the locus of adaptation were the visuo-motor interface, as Held, for instance, would have it, there should be no inter-modal transfer. There was more or less perfect transfer

between the aural and the visual conditions. However, proponents of this theory may claim simply that aural input is not directly linked to the motor system, but is recoded in terms of visual space. There is plenty of evidence, after all, that in matters of spatial location the auditory system is secondary to the visual. Motor learning, the learning of 'a new pattern of muscle contraction', is ruled out by the perfect inter-task transfer, i.e. by the lack of the sort of generalisation gradient that characterises learning, and so we are left with proprioceptive change. This last argument seems to be somewhat weakened by the very similar nature of the tasks. All that is involved is pointing to (spatially) different targets to those used during adaptation. True, they do represent different patterns of muscle contractions, but since Lashley, at least, two things have been clear; that there are purely motor patterns which run off without control from input from the external senses, and that these are more than patterns of muscle contractions. It is not in

the least surprising that if perfect generalisation can occur for arpeggios played in different keys on the piano keyboard, it can occur for pointing to targets located at different points in space. In any case localisation of hand or arm is more accurate if active movement is allowed demonstrating that monitoring of efference plays as large a part in position sense as afference. Indeed Harris (1964) has

allowed this, and it is no longer clear what it means to say that what is altered is the felt position of the hand, rather than the motor output. Moreover, what is at issue is not the formation of different patterns of efference, but the production of these patterns to different stimuli. The proprioceptive solution, in any case, does not fit the facts. Harris says that adaptation involves a change in the felt position of the hand such that the subject comes to feel that he is pointing ahead, when he is pointing to the side. However, after adaptation the situation is simply that the subject feels he is pointing ahead, when he is in fact pointing to the side. Subjects do indeed, as Harris reports, evince surprise when they see where they are pointing, but only when they see, that is when they see where their hand is relative to the median plane of their body. One obvious feature of Harris's theory is the recognition that the motor side of visuo-motor co-ordination has an afferent component, proprioception. He also recognised that the visual side had a motor component, eye movements. His definition of visual straight ahead involved, as it should have, the position of the eyes. An object was straight ahead if it fell on the fovea when the eyes were pointing straight ahead with respect to the body. Genuine perceptual adaptation, by his definition, would have been if straight ahead had altered. If this had occurred, it could have been due to either the re-calibration of the spatial values of retinal positions, or the

re-calibration of the spatial values of eye positions. He did not follow this up, because, of course, he interpreted his results as showing that no alteration of the visual straight ahead had taken place. As was shown, his interpretation was certainly wrong. What seems more reasonable is that the idea 'visually straight ahead' is rather complex involving, as it does, various relations between several variables, and that these can be uncoupled and re-coupled for particular values of the variables without affecting the whole system. The obvious interpretation of what occurs is that, on putting on the prisms, the subject has to move his eyes to foveate the target. This specifies that the target is at a particular location in space, and the subject makes the 'appropriate' arm movements. These do not work. Other arm movements are made, which do work, and these become associated with that particular eye position. This solution was first propounded by Helmholtz(1862), and was used by Wooster (1923) to explain the results of an experiment very similar to Harris's. More recently, it has been shown that the Wooster-Harris procedure does lead to change of gaze when subjects are asked to look straight ahead. Howard and Templeton quote evidence of their own to show that eye position does adapt. Nevertheless, they argue that in Harris's experiment re-calibration occurs at the arm rather than the eye. Perhaps they mean that no change of retinal values occurs.

However, it must be admitted that Harris has demonstrated something which looks more like adaptation than learning. The (presumably) automatic transfer across modalities rules out any straight motor-learning explanation. Also, the lack of inter-manual transfer may argue against perceptual adaptation, but it also argues against motor-learning, for it is well established that even relatively complex tasks like mirror-drawing show considerable inter-manual transfer (Ewert, 1926). Considering also, the existence of after-effects, and the occurrence of change without error-feedback or conscious correction, it begins to look like at least two, and possibly three, different things are happening. Firstly, there is motor learning; this is characterised by

- (1) trial and error learning,
- (2) no inter-modal transfer,
- (3) some inter-manual transfer,
- (4) generalisation gradient from task to task.

Secondly, there is some sort of adaptation or re-calibration, and this is characterised by:

- (1) no error feedback or conscious correction required.
- (2) inter-modal transfer,
- (3) no inter-manual transfer,
- (4) inter-task transfer.

One possibility is that these two forms of adaptation can occur independently, but that the first might facilitate the second, and that it might also enable and facilitate a third sort of adaptation, genuine

perceptual adaptation. Another possibility is that all the procedures mentioned might bring about learning, and that this might enable and facilitate perceptual adaptation. In this case, any effects which seemed inexplicable on the basis of learning, after effects, for instance, might be ascribed to perceptual change brought about by learning.

It still remains to answer the question of whether or not the world appears the same as it used to after adaptation. For the reasons given, this is usually argued on the basis of evidence from studies involving re-arrangements other than lateral displacement. Firstly, the question of inversion and re-inversion will be discussed. It has to be noted that this is a very radical sort of re-arrangement, and a negative answer to the question of perceptual adaptation here does not commit one to a negative answer in other, less drastic circumstances (e.g. partial rotation). The question is then, after donning inverting spectacles and allowing time for the most complete adaptation possible, does the world appear upright. Howard and Templeton recognise three different meanings of upright:

- (1) motor co-ordination upright, which depends on whether or not movements are effectively related to visual targets.
- (2) inter-sensory upright, which depends on whether judgements of upright made on the basis of visual information are consistent and harmonious with

judgements of upright made on the basis of information from other sensory modalities, particularly from gravity sensors,

(3) behavioural-polarity upright, which depends on whether behaviour to mono-oriented objects is appropriate.

Taking the third sort of upright, for the moment. The world is polarised with respect to gravity. Objects are also polarised with respect to other objects, of course, but this sort of intra-field polarity is not at issue here. It is possible to have this sort of orientation without gravity sense, all that is required is that we maintain a consistent orientation to the objects. This may require gravity, of course, but not any sense of it. We still see the world as upright when we are ^afloating, although there is no effect of gravity, and we see the world as upside down if we look at it with our heads between our legs, although gravitation and retinal projection are in harmony. This sort of upright is, then, a matter of memory. There are a number of ways of discerning whether normal behavioural polarity obtains.

- (1) verbal - use of the label upside down.
- (2) speed of recognition.
- (3) correctness of recognition of top and bottom of mono-oriented objects.
- (4) ability to recognise polarised movements.
- (5) first figure to be recognised in composite ambiguous figures.

Some of these tests seem necessarily to tap the same

skill, (3) and (5), for instance, and some not so, but for now it is assumed that all do. It is clear that although memory is involved, more than a feeling of familiarity is at issue, and this is, presumably, why behavioural polarity upright was selected as a name.

This is, then, a memory trace theory, but implying two sorts of memory. The first might be called 'comparison memory'. Without at the moment enquiring too closely into what comprises either of the objects compared, it must be the case that the feeling of strangeness or impropriety pertains to this. The second sort is "implementation memory", which consists in implementing procedures for the interpretation of stimuli and the identification of objects. Of course, there is evidence for operations of the first sort. Stratton reports that firstly things seemed strange and unfamiliar, then he lost that feeling, but that it returned to him the moment he recollected consciously what they had looked like before. Equally, it is known that new habits can be developed for the interpretation of ambiguous staircases or figures. But is this enough? Appearance is different from identity, and we can direct our attention to the appearance of things. Indeed, we remember appearances, or the comments of Stratton would make no sense. The question remains of whether, after the decline of feelings of strangeness, after the formation of new habits for the interpretation of ambiguous figures, there is a third stage of adaptation,

and if there is, of what is its basis. This stage would be signalled by the absence of any feeling of strangeness, and of any judged difference, between how things looked now and how things looked then when the subject was asked consciously to recall how things looked to him then.

Rock's theory is based on memory, explicitly. He holds what is, basically, Berkeley's view as regards the separate nature of the visual and tactual codes, and the consequent irrelevance of retinal position. An entire scene is perceived upright if the sky is perceived in the same direction as regards the ground as the eye is as regards the feet. An object is upright if it is in its correct relation to the ground, or to the observer's axis. Rock considers a number of alternative answers to the question of why an object looks upside down when viewed through inverting spectacles.

(1) Because of gravity. No. Lie down horizontally, and put on the inverting spectacles; things still look upside down.

(2) Because of proprioception. No. Look through the spectacles at your feet, and there is no conflict. Your feet feel down (next to the ground), and they look next to the ground (down).

(3) Because of conflict with acquired motor habits/tactual expectancies. But there is no conflict in the case of a chimney.

What is at issue is a learned association between an

image and a part of the retina, he says. That is, what is learned is a picture and its position on the retina. However, the example of the chimney would not apply now as I sit on the fourth floor of the library, looking down on the chimneys. So, it is not absolute position that matters, but, perhaps, relative position or orientation. This is important, for, although relative individual locations on the retina would normally be specified on a co-ordinate system, they need not be for the theory of local signs. All that is necessary is that they are uniquely labelled each independently of the others, perhaps, like Alaska, New York, and system, since we can move our eyes directly to any location from any other. Rock makes the distinction between orientation with respect to gravity, or with respect to any other external frame of reference such as earth and sky, and orientation with respect to the body's axis, and insists that with respect to PERCEPTUAL adaptation, only the latter is relevant. He has shown that we can discriminate up and down with respect to the body's axis. He did not allow eye movements, but disqualification of actual movements is irrelevant. Rock clearly believes that the basis of what is remembered, the memory trace, consists of copies of the retinal stimulation, copies of the pictures painted on the retina.

However, there is another possibility, the one advocated here, that the trace consists of a number of

different representations at different levels. These representations are schemata, and at the 'lowest' level they are schemata for eye movements, that is, they can be translated into eye-movements and predictions of the effects of these eye-movements on retinal stimulation. Howard (1974) has proposed a theory which is similar in some ways. He sees perception as consisting of two levels, descriptive processes and stimulus bound processes, and the descriptive processes are described as schemata in much the same sense as here. However, he does not see the lower level as schemata, as involving actions, decision rules, etc., but simply as a matter of receiving stimulus energy and processing it in a determinate, bottom-up manner. The theory espoused here does not deny that such stimulus bound processes occur, of course, but simply that they are a part of perception, of visual consciousness, actually and potentially. This theory which sees all levels of perception as the result of constructive processes will be referred to as the representation theory. The alternative which allows a lower level completely determined by the stimulus energy will be referred to as stimulus theories. They include both Rock's and Howard's theories. Stimulus theories must either predict no perceptual adaptation or adaptation via change of retinal values independent of adaptation of head/eye movements.

As regards prism adaptation, the theories make

different predictions. The representation theory predicts that adaptation to displacement is accompanied by a change in the direction of gaze labelled as straight ahead. This means that when prisms are first donned the eyes move to fixate the target, and that this new direction of gaze becomes straight ahead. There is an alternative, of course, that the eyes are kept determinedly straight ahead. In this case what would have to change would be the retinal position labelled as straight ahead, and all other retinal positions in relation. A result of this would be that we could not foveate (look at) what we were looking at (directing our eyes at). However, the difficulty in deciding whether or not a change in straight ahead is a visual change makes this an unsuitable test between the theories. This problem does not arise, of course, with inversion or left-right reversal. would remain the centre, but the top would become the bottom and the bottom the top, or the left would become the right and the right, left. One result of this is that we should tend to move our eyes up or left in circumstances in which we should previously have moved them down or right. The other component of gaze, head movements, will function under the same rules as previously, i.e. to fix gaze on something to the left, move the head to the left. Normally, of course, head and eye movements are closely co-ordinated, and the disruption caused is experienced as a loss of position constancy. Adaptation to this occurs, of course, but now there are three systems

(involving eye, head, and instrumental response) rather than two (involving exploratory and instrumental responses). There is some evidence that in the exploratory system, eye movements are the principal response, or at least that eye movements have the more powerful effects on gaze contingent phenomena (e.g. Kohler, 1964). Ignoring head movements for the moment, then, there is no opportunity for change of retinal values independent of eye movements, and so the experimental situation at issue cannot serve to differentiate the theories. One circumstance that would permit differentiation is where the inverting lenses or mirrors are attached to the eye rather than to the head, such that they move with the eyes. In this case, the direction of eye-movements and retinal direction are divorced, and eye movements remain co-ordinate with hand and foot movements. This is the real test of the Berkeley/Rock hypothesis. For if adaptation is possible here, there are indeed two codes, visual and motor, whose co-ordination is simply a matter of acquiring associations. As far as the theory discussed here is concerned, this circumstance is rather like knowing an object by accommodating the grasp of the hand to it, and then finding that this was not veridical against exploratory movements of the hand and fingers. This must be extremely difficult to adapt to. Nevertheless, the prediction is not necessarily no adaptation. What is being argued here is that perception as a form of consciousness is only possible as consciousness of

possibilities for action. Orientation, position, shape are all forms of spatial consciousness, that is consciousness of the possibility of movement and action. There are two sorts of actions relevant here, instrumental and exploratory. Instrumental action takes place with the body and exploratory, with the eyes, typically. They are not entirely separate classes, of course. Each whole body action brings about a change in the visual field, as does each head movement, whether or not they are performed for purely instrumental purposes. However, the body or the head can be considered in isolation as organs of action; retinas are not in themselves organs of action. If adaptation occurs, it will be no longer possible to distinguish a level which remains the same; there will be no turning back the attention and finding that things are not under inspection what they were supposed. Adaptation must needs be complete. This, of course, is to say that retinal values must change, that there is no possibility of a change or adaptation of eye movements without this.

Our theory is four stage:

- (1) sensori-motor co-ordination.
- (2) lack of strangeness due to changes in the contents of episodic memory.
- (3) distal adaptation, due to habit memory.
- (4) proximal adaptation, due to habit memory.

It is predicted that (4) does not occur with spectacles, but does with lenses. There is a report in the

literature that seems to contradict this. Taylor (1966) reports that his subject, Papert, claimed complete adaptation of the type being discussed. However, Papert's reports also make it abundantly clear that his field of vision was so restricted that he could not procure information by eye-movements, that he had to sample the world by head movements. This makes his situation functionally identical to the lens situation. There are several reports of different sorts of partial perceptual adaptation which are interpreted as intermediate states. These are common in reverse polarity situations, partly because this is where they would be noticed, but also because polarity is an all-or-nothing thing which does not allow for the same sort of gradual change as tilt or displacement. The most common form is that sometimes things appear one way and sometimes the other. This seems to occur at both the proximal and distal representations insofar as one can judge from the reports. This does not seem to favour any particular theory, except, perhaps, that it might be said to favour learning theories over recalibration theories.

There are cases where parts of the visual world seem normal and other parts reversed. Perhaps the most obvious cases involve writing; there are reports of incidents where cars are seen travelling on the correct (re-normalised) side of the road, but with number plates reversed, and reports of buildings the right way round,

but with the lettering on posters on the walls still reversed. Here it is clear that the distal representation, the representation in terms of bodily movements is adapted, but the proximal representation, the representation in terms of eye movements is not. This is to be expected in most cases where spectacles are worn. A variation on this sort of case is the subject of a debate between Howard and Templeton and Taylor (Howard and Templeton, 1966). The issue is a report by a subject of Kohler's who, when walking into a room with a window, saw all the objects in the room the right way up, and everything outside the room (i.e. everything seen through the window) as upside down. Taylor claims that, if asked to draw what had been seen, the result would have been a drawing with the objects inside the room in the usual orientation, and everything outside the room in the reverse orientation. Howard and Templeton take the view that the experience could not be captured by a drawing at all, but any drawing made would have to show both parts of the visual world in the same orientation. Since the subject was wearing goggles, and hence would have adapted in terms of his distal representation, but not his proximal, the theory proposed here predicts that if the task was set afterwards, the outcome would have been as Taylor predicts, but had the task been set in the situation with the subject's attention drawn to the features of the proximal representation, the outcome would have been as suggested by Howard and Templeton. In any case, these

instances provide strong support for the theory.

The third sort of case involves ghost objects. One of Kohler's subject's reported seeing mirror writing between lines of normalised writing, and Papert reported seeing two chairs, one in the normalised position and the other in the reversed. These were both with the set up previously described, where, although spectacles rather than lenses were worn, visual exploration was a matter of head movements rather than eye movements. Another possibility is that the ghosts represent the effects of adaptation to re-arrangement affecting eye movements one way and head movements the other, requiring a double spatial value for each retinal point. That retinal points are capable of taking two such values is known from the existence of monocular diplopia after operation for the correction of strabismus.

The crucial experiment remains, however, with inverting or reversing prisms or mirrors attached to the eye. This has not been performed satisfactorily. However, Festinger et al (1967) have performed a series of experiments on the relation between eye and hand movements and adaptation, including one with vertically mounted wedge prisms inducing curvature attached to the eye. They explicitly linked their work to an efferent theory of consciousness, that is to an action based theory of the sort proposed here. Welch (1974), reviewing their work sums up;

"They argued that if sensory information from an optically curved contour comes to induce an efferent readiness to make a straight motor movement (eye and/or limb), the line will be perceived as straight (i.e. adaptation will have occurred."

Their experiments supported this view. Unfortunately, however, despite the fact that they performed virtually the same experiment once with the device attached to the eyes, and once to the head, they did not differentiate the two types or levels of adaptation. Burnham (1968) and Gyr and Willey (1970) also supported this hypothesis.

It was argued earlier that the traditional idea of a sensation was in fact a compound of twin ideas, one deriving from a functional analysis of the perceptual process - a perceptual atom - and one deriving from a phenomenological analysis - a mode of looking at the world. This mode, it turns out, is equivalent to seeing the world as a set of affordances for eye movements. The other relevant mode consists of seeing the world as a set of affordances for body movements. The actual affordances signalled by a particular pattern of light at the retina can be altered. They can be altered for body part movements, but not for eye movements, or they can be altered for both. They cannot be altered for eye movements alone. Either sort of alteration produces adaptation, but of a different sort. Both are perceptual

adaptation, since perception is just consciousness of the set of affordances for particular sorts of action. However, it is the second sort that constitutes the change in the 'actual appearance of things' that has been at issue. Importantly, the first sort represents something more than sensori-motor re-coordination, which precedes it and is a necessary condition of it. This re-coordination is achieved, to a large extent, by learning, though there may be some re-calibration independent of learning.

CHAPTER 7: CONCLUSION.

7.1 CONCLUSION.

This thesis has been an attempt to outline a theory of visual perception. Initially, two criteria were set out by which such a theory should be judged. The first was that it should be able to account for the phenomena within its range of application; that is, in this case, it should be able to account for the phenomena usually subsumed under visual perception, things like object recognition, space perception, and so on. In this context, the phenomena are all the sorts of things that ordinarily constitute this sort of vision. It does not mean all the arcane effects reorted from psychological laboratories. This is partly because we are dealing with an outline, but also partly because this is the best and safest way to proceed. Controlled experimentation does, of course, have its place, but not as the basis for speculation or theorising about visual perception in general. Induction on such an artificial, narrow, and selective data base is necessarily sterile, and claims to practise the hypothetico-deductive method are simply disingenuous. Visual perception is part of our life; we know what it is we are trying to describe and explain, and we know it by other and far more powerful means than doing psychological experiments. Once we are provided

with theories, it may be that experiments can select between them, or, much more likely, can at least add weight to one account rather than another. For this reason, the earlier and larger part of the thesis is largely taken up with theories which philosophers have proposed on the basis of knowledge and experience that we all have access to as human beings. However, no attempt has been made to keep modern psychology out of this section, and wherever it has seemed appropriate reference has been made to experimental work on the same topics.

The second criterion was that any model proposed should allow plausible theories of other psychological functions; that is, it should be compatible with what we know about the relationship between perception and other areas of psychological functioning, such as emotion, action, thought and speech. This, of course, reinforces the points made above with respect to allowing the richest possible phenomenal base. It also exercises a strong independent force of its own. 'What we know' about the relationship between perception and action is, of course, contentious, but there is a strong case that this is not an external relationship. So, we are looking for theories that include concepts like 'action schema' which capture this sort of relationship, rather than concepts like 'association' which merely assert a mechanical link.

On the criteria discussed, the interesting theories are those of Berkeley and Kant. There are, however, other more or less implicit criteria. These are that the theory should be plausible, not only psychologically, but epistemologically and biologically. These last two turn out to be the same. Schelling saw this, and his theory reflects this with its sort of quasi-evolutionism. However, only in Macmurray do we get a really plausible story of how a veridical, visual consciousness can emerge as an aspect of an organism's adaptation to an environment through and for action in that environment. The rest of the thesis can be seen as an attempt to put some psychological flesh on Macmurray's philosophical skeleton, and to relate the result to some work in modern experimental psychology.

The theory presented here depends a great deal on that of J.J. Gibson. Like that, it states that visual perception is a matter of the active seeking out of information; that this search is conducted against the pattern of light falling at the eye and not upon the contents of some primitive layer of consciousness; that this search is guided by schemata; that these schemata can differentiate, and thus become capable of picking up more elaborate and complex patterns of invariance; that the pick-up of emotional tone or any other sort of valence is similarly the detection of high-level patterns of invariance under the guidance of appropriate schemata. It differs in the belief that the actual

content and experience of the perception is determined, not by the reception of the information from the environment, but by the activation of the hypothesis. This is an important difference in its own right, but it also represents a change of emphasis in that it delegitimises Gibson's contempt for what goes on in the head. This work may be seen as an attempt to give this output version of Gibson's theory a process interpretation.

Of course, Neisser has previously written on the same theme. He has produced an outline theory of a model of visual perception, which, like the one given here, is intended to incorporate Gibson's insights in a sort of process model, and reference has been made to this work throughout. However, he stays too close to Gibson. His perceptual cycles are very close to what is suggested in chapter 4, but the most obvious interpretation is that the actual perception is a result of the input phase, or perhaps that the two phases are so closely and determinately locked together, that it makes no difference. Of course, they are locked together in these situations where the information present in the light is more than enough to uniquely specify the stimulus configuration. As far as Gibson and Neisser are concerned this is true over the whole range of normal, ecological perception. This is simply not the case, however. The effects of motivation and set are facts of everyday life, and especially of clinical life.

Neisser assimilates attention to the activity of information pick-up. He claims that there is nothing more to attention than the operation of one perceptual cycle rather than another. He gives as an example watching one of two games superimposed on a video. According to his theory, if the subject attends to only one game, i.e. operates only one perceptual cycle, he should pick up nothing of the other game. Surely, this is not the case. Nothing is picked up of its structure as a game, that is true, but what about its spatial structure. We would, surely, be able to anticipate collisions between the two sets of players. Of course, Neisser allows that we sometimes do more than one thing at a time, operate more than one perceptual cycle. However, surely his theory would predict two perceptual worlds in this case, rather like when we watch television and cook a meal at the same time. Of course, the fact is that the worlds are perfectly integrated as regards their spatial structure. Neisser treats perceptual cycles more or less as single units. However, there must be levels, and they must brush across each other rather than be rigidly linked. Indeed, if they were rigidly linked any shift from of attention would result in a sudden, complete transformation of the perceptual world, with people and things appearing and disappearing as ghosts, and, as Neisser himself points out, this is just what does not happen. This does not contradict what was said in chapter 2 about our not seeing everything there to be seen. What happens is that

we always have an up- dated representation of the space around us at a relatively crude level, and it is within this framework that more specific schemata may operate or not.

We have presented an outline of a theory of visual perception as one mode of operation of a more general faculty for the creation of images for the planning and control of action in space. This is a complex theory made up of a number of propositions which, although closely related, are logically independent. These are that vision is specifically adapted for the control of bodily action; that it is dependent on bodily action; and that it is a form of action. We have seen how these propositions have appeared singly and in combination in previous, mainly philosophical, theories of space perception, and how their nature has changed as the dualist and intellectualist assumptions were challenged by successive critics. Of course, from such a complex theory a very large number of empirical hypotheses can be derived. Some of these will be obvious and/or trivial, and some will be so widely accepted as to be no longer in serious dispute. An example of the latter might be that learning can affect perception at least at the level of organisation. There remains, however, a substantial number which require defence. One of these might be the claim that higher level, presumably learned, processes can affect the actual sensible material, i.e. colour and form, of what is perceived.

However, it turns out that what is at issue here is not the actual experimental facts, but their interpretation. It is not in dispute that, in many cases, subjects report more than or other than what is really there in a display exactly as if it were there in the display. However, some explain this in terms of imagination or memory, or anything but perception. Of course, the distinction between imagination and perception is not allowed in the theory defended here, nor that between memory and perception, and so matters of experimental fact become matters of theoretical interpretation. Nevertheless, we would want the theory to be compatible at least with very specific details of experimental findings in important areas. We have shown this for adaptation to optical re-arrangement. This is peculiarly significant since it shows that the level of sensible material is negotiable, and is negotiable with respect to bodily action and active touch.

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